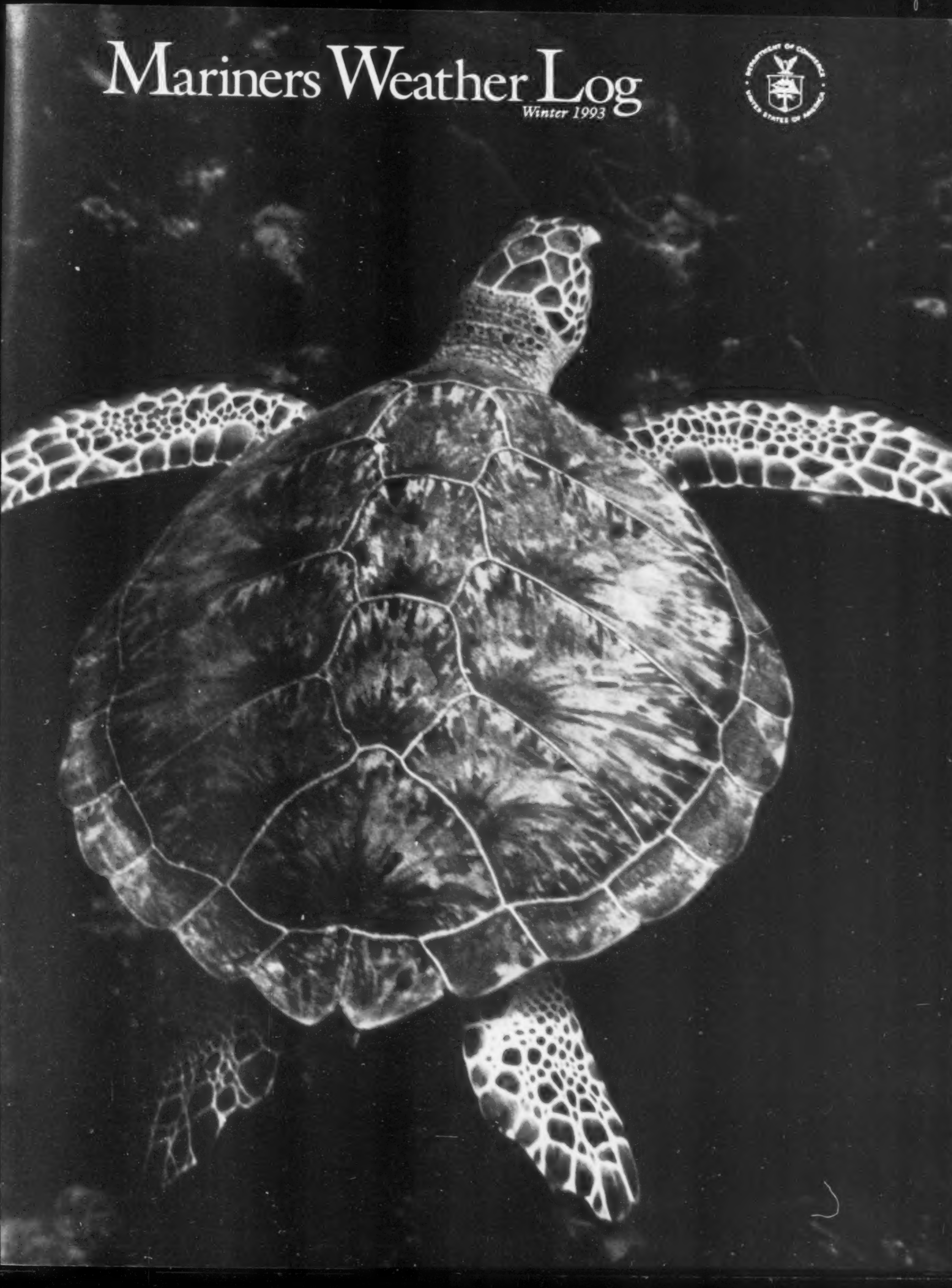
Mariners Weather Log

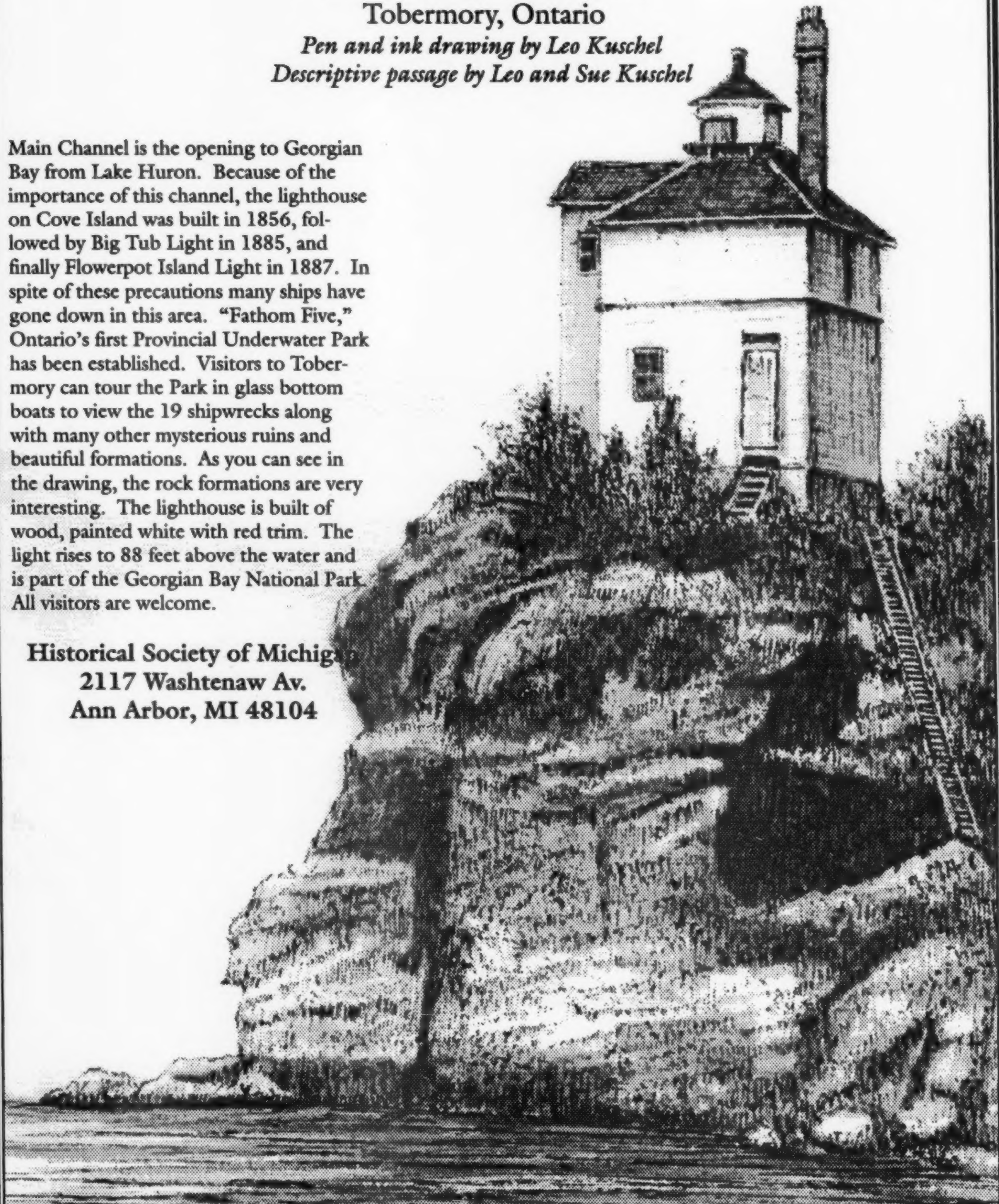
Winter 1993



Old Flowerpot Island Lighthouse

Georgian Bay, Lake Huron,
Tobermory, Ontario

Pen and ink drawing by Leo Kuschel
Descriptive passage by Leo and Sue Kuschel



Main Channel is the opening to Georgian Bay from Lake Huron. Because of the importance of this channel, the lighthouse on Cove Island was built in 1856, followed by Big Tub Light in 1885, and finally Flowerpot Island Light in 1887. In spite of these precautions many ships have gone down in this area. "Fathom Five," Ontario's first Provincial Underwater Park has been established. Visitors to Tobermory can tour the Park in glass bottom boats to view the 19 shipwrecks along with many other mysterious ruins and beautiful formations. As you can see in the drawing, the rock formations are very interesting. The lighthouse is built of wood, painted white with red trim. The light rises to 88 feet above the water and is part of the Georgian Bay National Park. All visitors are welcome.

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104

Mariners Weather Log

Winter 1993

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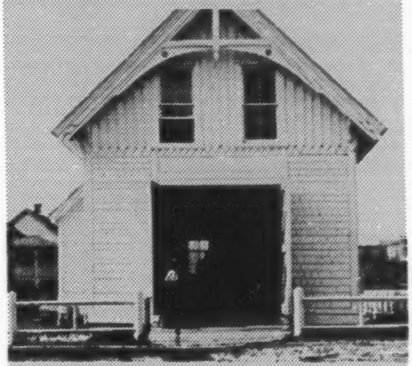
While Andrew was devastating, the Louisiana coast has suffered even more in the past. Story by Ken Ringle of the **Washington Post** on page 4. Sketch by Maxine Witt.

Cover: The Green turtle shares a place on the endangered species list with three other turtles in the Key Largo National Marine Sanctuary. One other turtle, the loggerhead is on the threatened list. Photograph by Steve May. Story on page 1a.

Back Cover: Sebastian Cabot most likely discovered Florida, but Henry Flagler opened the Keys with his railroad in 1908. The *Havana Special* could be ridden from Miami to Key West. Havana, Cuba was then only a steamship ride away. Story on page 1a. Photo kindly loaned by Seth Bramson.

Inside Back Cover: Hurricane Iniki demolished the Hawaiian Island of Kauai on September 11, 1992. This satellite photograph from Satellite Data Services Division was taken on the 10th. There is a brief story on page 77 and more to come in the next issue.



Seatack Life-Saving Station on page 35.

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Marine Weather Review

July, August, and September 1992

Mariners Weather Log

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July 1, 1993.

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From B to Z— Bowditch to Zegowitz

In December, Vince Zegowitz, Marine Observation Program Leader, and I had the opportunity to visit several maritime academies, partly in preparation for a series of articles in the *Log.* It is at these schools, throughout the U. S. that mariners should get their first exposure to weather (no pun intended). Each school we visited had an active meteorological program. Vince feels very strongly about the interaction between the academies and the National Weather Service and is doing everything in his power to see that they are properly equipped and are stressing the importance of the VOS program.

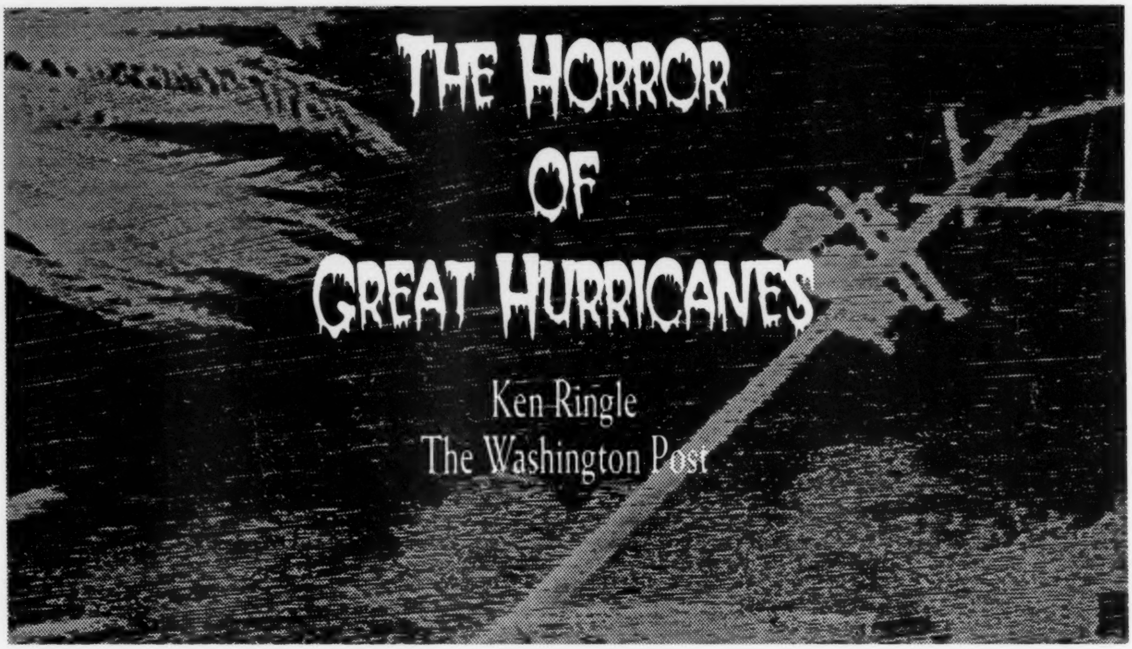
At each school— New York State Maritime Academy, the U. S. Merchant Marine Academy, Massachusetts Maritime Academy and Maine Maritime Academy— Vince gave a series of informal talks stressing the importance of weather observations to both the merchant mariner and the National Weather Service. There is no one more qualified than Vince, who began his career as a merchant mariner, on the lowest rung of the ladder and worked his way up. His marine experience plus his formal education gives him a unique and practical perspective on the marine weather program. In the 25 years I have been associated with the program, I have never seen anyone better.

In addition, Vince recently accompanied the cadets at Mass. Maritime on their annual cruise aboard the T/S ***Patriot State***. He was able to give hands on training in weather observing, which was well received by the students. In fact, they even named the weather shack in his honor. One of the most enthusiastic meteorological gurus also happens to be a professor at Massachusetts Maritime— Captain Jeffery Monroe. Captain Monroe is writing an article for the *Log* about the practical aspects of wave length and ship handling. He really knows his stuff. For now, we will have to settle for one of his astute observations made during the recent cruise— unfortunately in front of several navigational experts. In fairness to Jeff, it was made after Happy Hour at Crane's Beach, Parapet House in Barbados. Observing the brilliant, tropical sunset from the veranda, Jeff exclaimed, "Look there's Venus rising in the WEST. Ain't it beautiful." For the non-navigational readers simply replace Venus with the sun to realize the acuity of Jeff's observation.

All kidding aside, the relationship between the maritime academies and NOAA is at an all time high thanks to the efforts of people like Jeff Monroe, Professor Andy Chase (Maine Maritime), Captain Richard Stewart (U. S. Merchant Marine Academy) and Captain James De Simone (New York Maritime).

So where does Bowditch fit into all of this? First, Kathy Bowditch whose great, great, great, great Grandfather is *the* Nathaniel Bowditch, is a senior at New York Maritime— carrying on a grand tradition. If this weren't enough, we discovered another Bowditch (related) at the U. S. Merchant Marine Academy. And to top it off, Professor Andy Chase at Maine Maritime is a direct descendant on his mother's side. All in all it was a very worthwhile trip and quite encouraging to see clean-cut, eager cadets with an unabashed love for the sea at all the schools we visited.


Katherine Bowditch and Vince Zegowitz



June, too soon.
In July, bye and bye.
August, come they must.
In September—remember!
Come October, all over.

–Traditional Caribbean saying about hurricanes

Whenever the August sky lowered over the Gulf beyond my grandmother's house in Louisiana and the rambling old cypress structure began to moan and creak under the lash of the windblown rain, we would end up at the dining room table eating cold cereal by flickering candles—the power would be off by then—and she would tell us again the story of the Last Island Storm.

It was the great hurricane of memory for her, though it occurred August 10, 1856, three years before she was born, and it haunted her normally cheerful mind on stormy summer days with a ghastly sense of premonition and possibility.

"All the fashionable people vacationed on that barrier island in the Gulf in those days to get away from the heat and yellow fever in New Orleans," she would say. "When the storm came and began blowing away the houses and washing over the island, they huddled in one of the hotels and prayed for deliverance. Then the wind stopped and the sun came out, and they ran out and danced on the beach thinking they'd been saved. But it was only the eye of the storm. And they were washed away."

Two young children and their mother—close friends of our family—had been among more than 250 victims, the children torn from their mother's arms by the raging water. The young mother's body was never found. The storm's last survivor, Emma Peletier, widow of our longtime family doctor, was still telling her story in 1935 at the age of 98. She had washed up on the beach unconscious at the feet of the man she would later marry.

Pirates from nearby marshes had appeared after the storm to loot the bodies of the dead.

Pirates from nearby marshes had appeared after the storm to loot the bodies of the dead, slicing off ringed fingers and ripping jeweled earrings from the flesh. My mother, now 85, could never bring herself to have her ears pierced after being raised on that story.

To have roots on the Gulf Coast is to grow up with hurricanes and hurricane stories like that, which may offer some comfort,

Ken Ringle is a feature writer for the *Washington Post*. This article appeared in the *Washington Post* on September 13, 1992.

however cold, to the stricken survivors of last year's Hurricane Andrew.

Had the storm hit the Dade County lowlands with Camille's torrential rains and tidal surges much of south Florida might still be underwater.

If Andrew is being touted as the great storm of the century, what are we to make of Camille, whose 200 mph winds and 12–mile–wide, 25–foot–high storm surge in 1969 gouged open the graves of Gulf Coast cemeteries and strung corpses in the trees like so much Spanish moss?

Camille struck with the force of several hydrogen bombs, altering forever the topography of the Mississippi coast. More than 250 were dead before Camille swept up the Mississippi Valley as a tropical storm. Then, three days and 1,000 miles after it hit the coast, it took a right turn over West Virginia and, in some sort of terrifying meteorological joke, dumped 20 to 40 inches of rain in eight hours on Nelson County, VA. hosing away entire mountainsides, drowning or burying more than 150 more people and touching off 100–year–record floods in the James River basin.

Now *that* was a hurricane.

The day after Camille, there was an eerie silence: the birds had all been drowned in the trees. But the air for some reason was filled with butterflies.

For some of us who walked in the death–stinking footsteps of Camille, unearthing bodies and parts of bodies—from those horror comic landscapes, Hurricane Andrew, despite its massive material devastation, looks like more a middleweight among disasters. It was singularly devoid of the three qualities that have always marked the most devastating hurricanes: unpredictable track and landfall, massive storm surge, and immense rainfall.

Any suggestion that it was more than that is extraordinarily dangerous. It encourages people to think Andrew's sort of damage is the worst we have to fear. It endorses the rebuilding of unconscionable development in highly dangerous flood zones—often with public funds. And it leads public officials—not to mention the public itself—to believe that massive evacuation of a place like southern Florida is truly manageable because it worked this time. Few people who have spent serious time with hurricanes will agree with any of those propositions. Hurricane Andrew, after all, wasn't even a Category 5 storm.

Flying back and forth above Andrew's track the day after the

The wave setup on top of the storm surge contributed to the overall water height during Hurricane Camille. The result was a 25–foot wall of water, which destroyed more than 6,000 homes along the Louisiana–Mississippi–Alabama coast.

Last Island

While there were stronger hurricanes in the Gulf of Mexico in the 1800s, this storm has become wrapped in the legends of Louisana, mainly because of the terrible devastation of this resort. This abbreviated account was excerpted in sections from a wonderfully definitive book by James M. Sothern, entitled ***Last Island****, published by Cheri Publications. The sketch was done by Maxine Witt of Houma. The book is available from James Sothern, 208 Wilson Av., Houma, LA 70364. The cost is $10.50 plus shipping.*

During the middle 1800s most of the major towns in southern Louisiana were located on rivers or bayous that could be navigated by steamboats, and the farms and plantations were strung out in between. The simple home of the small farmer was, for the most part, the typical Acadian house which had a high– pitched gable roof covered with cypress shingles. The houses provided a large front porch or "gallerie" with rocking chairs and perhaps a large swing to catch a *cool breeze.* One or more large fireplaces was built with the chimney outside the house, and a split cypress picket fence usually surrounded the yard. Several moss–draped live oaks often provided shade, and azaleas, jasmine, and magnolias provided color and fragrance. In contrast to the humble Acadian house were the large plantation mansions built by the more prosperous planters. Of course, there were all size gradations in between, as young Louisiana had no real class stratification as was common to Europe and elsewhere.

Some of the planters led a life of almost complete leisure since their great wealth enabled them to hire foremen and administrators to keep the plantations functioning profitably even during their absences. During the winter months entire families would journey to New Orleans where a suite at the magnificent St. Charles Hotel or an apartment in the French Quarter was reserved for the duration of the opera season. In the summer many would pack up and board a steamboat, usually right out in front of their houses, and journey to such summer resorts as Last Island, Caillou Island, or Grand Isle. For many the mid 1800s was a good time to be alive. Not that all was perfect, for in addition to summer heat, the dreaded yellow fever epidemic made these islands attractive to those that could afford them. All that was known about the disease at the time was that it was rarely contracted in areas touched by salt water and was most prevalent in the summer months. In 1853 yellow fever claimed over 11,000 lives in New Orleans alone.

This was the setting in the summer 1856 when visitors made their way to Last Island, which had become a fashionable and popular resort. Most of the houses and cottages, as well as Muggah's Billard House and Pecot's Boarding House were situated near the western end of the island strung out casually along the beach facing the Gulf. To the rear of the village, running roughly parallel to the beach, was Village Bayou, which served as a quiet harbor for boats of all kinds.

The summer of 1856 had been unusually hot but as the fateful day approached, a gentle breeze from the north began to blow, bringing its cooling whispers to the happy isle. This gentle breeze, however, gradually became stronger and somewhat annoying in its persistence. On Friday morning, August 8, the wind had increased to the point where the waters of Caillou Bay were crowding the north shore of the island. Although the wind blew steadily and with increasing velocity from the north, large swells with sheared tops were coming in off the Gulf— from the opposite direction.

W.W. Pugh, wealthy planter from Assumption, and also speaker of the House of Representatives for the state of Louisiana, was on the island with his family and describes the events of the storm in his memoirs:

On Saturday morning the 9th of August, the wind was strong from the North East, and the Gulf was covered with angry waves, some few who ventured into the water were disgusted with the roughness of Neptune's greeting, and beat a hasty retreat. The wind continued all day, and many contented themselves with admiring the Gulf at a distance. The sight was a novel one to most persons, and very grand, some expressed a desire to witness a storm at sea, without thinking of the sandy foundation on which they stood. At night there was a ball in the Hotel, which all attended, little thinking of the sad changes which a few hours would bring about...

The party broke up about midnight, and the gay crowd sought their couches, fortunately ignorant of the fate which awaited so many of them...

About two o'clock the bay mentioned above was completely filled and the water continued to rise until it passed over the island, and mixed with that of the Gulf. About 4 o'clock the wind suddenly shifted, and blew with redoubled force, from the Gulf and the water in heavy waves poured ... over the island. Now the struggle for life commenced, and horror was painted on every face, no one exposed, could withstand the force of the waves, and all who were caught without shelter or something to hold on to fell victims to the merciless waters. Some floated off to unknown parts, on pieces of timber, several took passage on a billard table, two boys found safety in a broken oven, and the writer and a part of his family were fortunate enough to find shelter behind the debris of the dining room, from which they gradually retreated as the timbers were carried off, and finally held on to the remains of a large water cistern, which had bursted, but was held in its place by its iron hoops.

The water was blown with such extence violence, that you were partially blinded by the salt spray, and when it came in contact with the face, it felt as if you had received a charge of small shot.

To the risk of being washed off was superadded the danger

Legend

of immediate death from the planks, shingle and scantling hurled through the air, in all directions by the force of the wind.

*During the morning the steamer **Star** (the regular passenger boat) came in filled with visitors from New Orleans and the lower parishes. The steamer was old, and not calculated to withstand very rough weather. During the evening she dragged her anchors, and was beached high up on land... At sunset there was a partial calm, and many who had escaped the rush of water availed themselves of this momentary lull, and sought a place of refuge in the hull of the steamboat.*

No one can give a correct description of the mental sufferings of those who were exposed to the horrors of that dreadful night, uncertain as to their own fate, and ignorant of the whereabouts of the members of their family. Each mourned the loss of a near relative or friend, and in many instances the mournful anticipations were fully realized. In my own case, my family became separated as we left the hotel, and took refuge for a short time in a low cabin in the rear. A son, daughter, child and nurse, when driven from this point by the dangerous condition of the house, were separated from us, and next morning we learned that the two had first gone from the turtle pen to the steamer and were safe, but the child and nurse were both drowned...

When morning came at last (the night seemed as if it would last forever) a scene of great desolation presented itself. There was not a house left standing, and the whole island seemed to be covered with piles of lumbers, and remains of brick works...

The bodies of the drowned could be seen in every direction arrested by the prairies grass, and low shrubs on the island... The eleventh and twelfth were passed in burying the bodies of the dead. Many were carried off by the waves and never found. Some few were rescued after being mourned as dead.

An estimate of the survivors would seem to number about 200, and from the lists it would seem there were somewhere between 400 and 500 people on the island when the storm struck. Aboard the ***Star***, Captain Abe Smith and his crew also engaged in a struggle for life. The anchors started to drag as the force of the wind made the high, double cabins of the steamer act as a sail— she was being blown back into the bay. Frantically, the perceptive seaman ordered his men to tear away the superstructure. All above the gunwales was jettisoned; the fine cabins, the ornate rails, the furniture, all swept away until nothing was left but the bare hull with two blackened stacks protruding above the exposed engines and boilers. As a result of the heroic efforts of Captain Smith and the crew of the ***Star***, more than half of the people on Last Island that fateful August were saved. Had not the ***Star*** arrived and been able to hold fast, only a handful would have survived.

The hurricane of August 10, 1856 must have been one of the most powerful of the century. Damage was reported throughout the state, with great losses sustained. Crops were blown down, buildings demolished; ships in port were in ruins, and those unfortunate to be at sea were lost. Word of the horror on Last Island slowly spread throughout the mainland and caused such widespread grief and concern that the impetus created by this tragic episode lingers on today. For a time the curious would come to view the ruins, and for years afterward the weathered ribs of the ***Star*** could be seen curving up from the dunes in valiant witness of her steadfastness, but in time the waves and shifting sands would erase all traces of even that splendid monument. Where once stood the Village of Last Island, now only memories remain.

Every murmur of the cooling surf in its quietest mood, and every sigh of the summer breeze in it balmiest breathings will be a saddening memento of the time when a happy crowd were gathered there for innocent enjoyment, and the storm came suddenly and heaped the waters upon them. The sea and winds will seem to chant and eternal dirge for the dead.

Editors, The Daily Picayune, circa 1856

Within a small family cemetery near Napoleonville lies the body of little Loula Pugh, beneath moss-draped oaks and ivy.

storm hit Florida, I found most remarkable not the seriousness of the damage—fairly typical for the peak of a Category 4 hurricane—but the narrowness of the primary damage corridor, which appeared, perhaps deceptively, scarcely more than two or three miles wide. Within that corridor, destruction was often absolute, as in the much-photographed Homestead trailer park and Tamiami Airport. But it was almost all wind damage.

For Andrew was very definitely not "The Big One" meteorologists have been warning Florida about for decades....

Water damage from hurricane is almost always far greater, yet with Andrew there was almost none. Had the storm hit the Dade County lowlands with Camille's torrential rains and tidal surges much of south Florida might still be underwater. Hundreds of evacuees would have drowned in their fleeing cars.

Andrew also appears to have been one of the most predictable hurricanes ever tracked. With unusual strength in both its steering currents and its adjacent weather systems, Andrew moved almost unwaveringly from east to west as it stalled offshore for days or changed direction repeatedly as hurricanes are wont to do, many evacuees would have grown impatient and gone home and things would have been far, far worse

In 1957, Audrey—a rare June hurricane—was jogging steadily westward toward Mexico when, in the middle of the night, it made an abrupt 90-degree turn, doubled its forward speed, and slammed into the sleeping community of Cameron, LA. with 12-foot tidal surge that killed some 390 people.

I remember Audrey with particular clarity because it was the first major story I covered as a journalist. I was a teenage photographer at the time and drove the last car across Bayou Petite Anse before the storm surge hit Iberia Parish. The water was up to the door handles. The inrushing tide made a three-foot bow wave against supports of the flooded bridge and almost carried me downstream. And we were 80 miles from the storm's center.

None of this is meant to minimize the unquestioned suffering in Florida and Louisiana that Andrew caused, only to put that damage into some perspective. For Andrew was very definitely not "The Big One" meteorologists have been warning Florida about for decades. The Big One is still out there—maybe next year, conceivably next week—and it might be a good idea if we remembered what *really* serious hurricanes do. For the two things those who've lived through many hurricanes always emphasize is that a hurricane is the most powerful force in nature. And no two behave exactly the same.

In 1972, Hurricane Agnes, for example, should have been a patsy of a storm. It was only a Category 1 hurricane, actually little more than a tropical storm. But its vast size and monsoon rains killed 122 persons in 1972, and touched off floods in every major river system in the mid-Atlantic states, some of whose consequences still endure.

Camille was the most powerful storm to hit the U.S. mainland in this century, stronger even than the 1900 hurricane that killed 6,000 in Galveston, TX. But Hurricane Gilbert, a category 5 storm that struck Mexico in 1988, was just as intense and five times as large—the size of the entire Gulf of Mexico.

Each hurricane seems to spawn its own effects. Three years ago when Hurricane Hugo slammed into St. Croix, my cousin, Kathy, a registered nurse not given

More than 270 boats were damaged or destroyed during Camille. The fishing trawler **Wayde Klein** *came to rest in the front yard of a residence in Biloxi, MS. Photograph courtesy of the National Ocean Service, which at that time was called the Coast and Geodetic Survey.*

to exaggeration, huddled in an interior closet, "one hand on the dog, the other on a bottle of Jim Beam whiskey" while her house literally blew to pieces around her. In the brief calm of the eye, she and her husband managed to run to their car "which somehow was still there, and somehow started," and raced into the lee of a nearby hill. They rode out the rest of the storm, the car rocking as the wind screamed overhead. And theirs was a new house, much of it concrete.

"But the worst was afterward," she said. "Not just the bands of looters with their guns but the strange sense of nature still askew. For example, St. Croix is normally a very green place, but now there weren't any leaves .... And in the days afterwards, the whole island had these swarms of bees and wasps. You couldn't get away from them. We were stung repeatedly. "

The day after Camille, there was an eerie silence: the birds had all been drowned in the trees. But the air, for some reason, was alive with butterflies.

If hurricanes differ vastly in their effects, they also differ vastly in the amount of attention we seem to pay to them. Destructiveness, even deadliness, is not necessarily a measure. Andrew, for example, may end up little more destructive than Hugo 3 years ago, but it's getting much more attention. The reasons are several. Hugo's damage in the Carolinas was widespread, extending more than 100 miles inland, away from major media outlets. Andrew's was compact, dramatically visual and just minutes from the Miami airport and a quick flight to the evening news. Hugo's homelessness was often rural, culturally removed from the lives and experiences of reporters covering the story. Andrew's is suburban—blasted cul-de-sacs and split-levels easily identifiable to readers and viewers in major media markets. There is also the political factor. Hugo's damage occurred the year *after* the last presidential election. Who's going to tell a registered voter in Florida this year that he can't rebuild a storm-vulnerable home in a flood plain?

Some of these factors have always been operating. For example, the Last Island Storm of 1856 remains far better known in history than the 1893 hurricane that caused some 2,000 deaths on nearby Cheniere Caminada. The 1893 victims were small farmers, trappers, and fishermen little known outside their parish. The Last Island Storm claimed socially and politically prominent summer visitors from across southern Louisiana. At the time, writers were starting to portray Last Island as a potential rival to Newport, R.I. and Cape May, N.J., as a fashionable summer playground. Owners of the St. Charles Hotel in New Orleans were even well along with plans to build an elegant 600-room hotel, the Trade Winds, on Last Island, to house the expected influx of visitors.

No federal flood insurance was available in those days, and disaster relief was largely a do-it-yourself or help-your-neighbor proposition.

In the wake of the hurricane, the Trade Winds was never built. No federal flood insurance was available in those days, and disaster relief was largely a do-it-yourself or help-your-neighbor proposition. People relied for their protection on long memories and common sense: on the hard lessons about nature passed from generation to generation as my grandmother passed her knowledge on to me.

Last Island is still there, 90 miles southeast of New Orleans, some 10 miles off the coast of Terrebone Parish. On maps you'll find it under its French name, Isles Derniers, right near the spot where Andrew came ashore. By all accounts it's a beautiful place, unsurpassed for fishing, sunning and swimming, with almost always a gentle Gulf breeze. But no one has ever rebuilt the village that vanished there 136 years ago. In that part of Louisiana, at least, they still remember what The Big One can do.

Last Island

Before the Hurricane of 1856, Lost Island was roughly 25 miles long and 1 mile wide. This hurricane and continued erosion cut the island into four smaller parcels. The photographs on page 10 show. Raccoon Island before (top) and after (below) Andrew and on page 11 Whiskey Island before (top) and after (below) Andrew. Raccoon and Whiskey Islands are two of the segments that made

Legacy

up the original Last Island. The U.S. Geological Survey and the Louisiana Geological Survey have been tracking changes in the state's barrier islands and kindly provided the photographs. Geologists had predicted that the last vestige of Raccoon Island would disappear in 2001. Now after Andrew, they say it probably will be washed into the sea several years sooner.

NEXRAD NOW!

John Livingston
National Weather Service

Who has seen the wind?
Neither you or I.
But when the trees bow their heads,
the wind is passing by.
—Christina Rossetti

When a tornado roars straight for a community, a 2–minute warning may not be enough time to save lives. NEXRAD (Next Generation Radar) should soon increase those 2 minutes to 20 when weather networks around the country install the new Weather Surveillance Radar 1988 Doppler(WSR-88D).

While this radar was designed to track the deadly tornados, the benefits extend to the marine environment. Next to freak waves, the line squall is one of the most feared and unexpected weather events at sea. In the days of sailing vessels these squalls were particularly deadly. This is attested to by the modern day tragedies involving the *Pride of Baltimore* and the training vessel *Marques*. Even with modern vessels these squalls can cause problems, particularly along the coast and in port, where Doppler Radars will shine.

The National Weather Service (NWS) plans to revamp the marine program in conjunction with launching of this new generation of radars. Each year numerous thunderstorms develop over land and move over Galveston Bay and the coastal waters of Southeast Texas. Gusty winds and heavy rain often accompany these storms and the WSR-88D provided additional data with which to evaluate these

*The **Pride of Baltimore II** was built to rigid specifications, which enable it to sail the high seas according to U. S. Coast Guard standards. This beautiful vessel is in the VOS program and also carries a SEAS unit for National Weather Service observations. It will find immediate benefit from the Doppler radar that operates in the Washington, DC area.*

The WSR–88D features a radar dish 28 feet in diameter and is part of the system, which includes a transmitter and receiver.

storm elements. In events where thunderstorms develop over the Gulf of Mexico, the WSR-88D proved invaluable in providing information in an otherwise data sparse area. Data from the WSR-88D has been incorporated into warnings for the bays and coastal waters of Southeast Texas in numerous instances.

Why NEXRAD?

Described as "one of the great advances in the century," NEXRAD will finally allow meteorologists to *see* into tornadoes and other severe weather conditions and better gauge both direction and strength. Current radars, between 20 and 25 years old, have no way of measuring the behavior of the wind inside clouds and storms which bring about destructive weather. With the advent of this system, great changes will occur in both U. S. weather community and marine programs.

NEXRAD is a large leap forward from current weather radar. Not only does it provide high resolution reflectivity, but also valuable data on wind speed and direction. And where the previous radar system provided only basic reflectivity data, the WSR-88D uses computer systems to process the raw radar data into a large number of products that are then sent on to private meteorological companies, the media, emergency management officials, and private citizens.

The National Weather Service (NWS), the Department of Defense (DOD) and the Federal Aviation Administration (FAA) in the Department of Transportation joined together to develop this new system. Beginning in January 1993, NWS and DOD meteorologists will be able to train on coastal WSR-88D units in Houston/Galveston, Texas; Melbourne, Florida; Eglin Air Force Base, Florida; and Washington, DC. As each new coastal WSR-88D unit is commissioned, older units are being phased out.

Where NEXRAD?

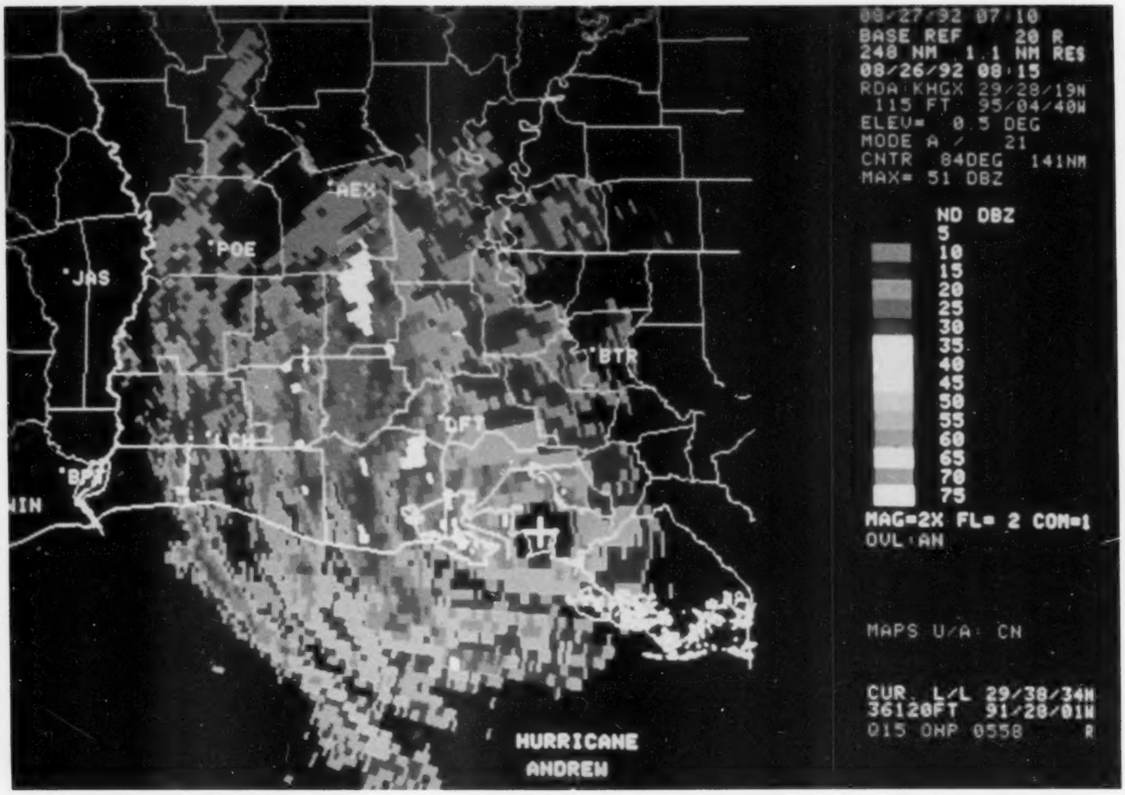
Over the next 4 years, the NEXRAD system will form a network of over 100 and cover the 50 states as well as Puerto Rico, the Virgin Islands, the Bahamas, and Guam. Marine coverage will include the Atlantic coast, the Gulf of Mexico, portions of the Caribbean Sea, the Great Lakes, inland waterways and rivers, the Pacific and Gulf of Alaska coasts, the Hawaiian Islands, and Guam. This coverage is expected to give the NWS the ability to better diagnose a wide variety of weather systems through its high quality conventional reflectivity data in addition to information on winds from the Doppler capability.

How NEXRAD?

While the NEXRAD system is new, the principle is not. The Doppler effect is named after the 19th century Austrian physicist, Christian Doppler. He first observed and described this effect by observing the change of pitch of a train whistle, which is higher as a train approaches a bystander and falls to a lower pitch as it passes him. A radar specifically designed to measure this Doppler frequency shift was found to be feasible and was capable of measuring the velocity of anything moving toward or away from it even when the movement is quite slow, thereby achieving a new level of information impossible with conventional radar.

The WSR-88D applies a two system approach for acquiring and processing the radar data. The Radar Data Acquisition (RDA) portion of the system includes the transmitter and receiver as well as the tower, pedestal, and antenna. The dish is 28 feet in diameter and the radar pulses broadcast using a wavelength near 10 centimeters (or a frequency near 3000 megahertz). The resulting beam width is one degree, a marked improvement from the previous network weather radars. This wavelength minimizes attenuation or loss of signal as the radar pulse travels from the antenna to the maximum range of 248 nautical miles and back. Preliminary processing of the raw data to remove ground clutter is done at the RDA. The data then passes to the Radar Product Generator (RPG).

At the RPG, processing uses a set of computer



Hurricane Andrew was sighted by NEXRADs at both Melbourne, FL and League City, TX. This example is the Base Reflectivity product from the Houston/Galveston WSR-88D at 0815 UTC on August 26, 1992 while Hurricane Andrew was making landfall along the Louisiana coast, 190 nautical miles from the radar. In addition to the detailed information obtained at long ranges, the radar was used to determine the latitude and longitude of the eye, the forward speed of the eye, and the relationship of the storm to geographical features.

programs called algorithms. These algorithms perform compositing and contouring on the raw data. They analyze the data to determine the location and structure of thunderstorms. By tracking past positions of thunderstorms, short–term forecasts can be plotted. Another set of algorithms determines the possibility of hail and the location, depth, and strength within thunderstorms of a mesocyclone or rotating updraft. It is the mesocyclone that can be the precursor to tornado development. Other algorithms can estimate liquid content within a column and surface rainfall. And yet other algorithms use the velocity data to derive a wind profile in the vertical.

The new system was developed in Oklahoma, a state familiar with severe thunderstorms and killer tornadoes. There were concerns that using Oklahoma as a design area could lead to a system that worked well only in the high plains of North America. Fortunately, a great amount of flexibility was designed into the system. The computer programs and algorithms can and will be adapted to the differing environments the WSR-88Ds will use.

The products once created at the RPG will be available to the users and distributed to workstations at the NWS as well as other government agencies. The RPG also sends many of the same products to the private meteorological community through the NEXRAD Information Dissemination System (NIDS). Under this system four private meteorological corporations have equal access to the products from all the radars. They then redistribute the data to the many end users

The marine community will also be able to use this data through the same means of access they have to the current radar data. NOAA Weather Radio (NWR) will be the primary mode of communicating information from the new radar to users operating in the coastal waters. In fact, the NWS offices that presently have access to the WSR-88D data are already incorporat-

ing that information into their NWR products. Distribution of other conventional text and graphic information will follow the same format when the new radars replace the old.

Seeing the Wind

The most striking new information from the WSR-88D are wind speed and direction data. By comparing the phase of the returned signal to that of the transmitted signal, the shift in phase is measured. Through application of the Doppler principle, the velocity of the sample volume with respect to the radar is determined. A series of computer programs operate on the raw velocities performing quality checks and comparisons. The final product is color coded velocities in knots displayed on a map background. Due to the physical constraints in acquiring and processing these data, only velocities towards and away from the radar can be determined.

Using these data in analysis and forecasting in the marine environment is multifaceted. The most obvious use is real–time wind speed and direction over a large area near the surface every few minutes. Other applications such as the locations of fronts, the structure of the winds in strong thunderstorms, and wind information on tropical storms and hurricanes hold great promise.

The early indication from NWS and other meteorologists are that data from the WSR-88D units is truly a large step forward. The WSR-88D at the Houston/Galveston NWS office was turned on in mid April 1992. Our experience through October of 1992 has shown that the improved reflectivity data allows our meteorologists to better track and forecast thunderstorms and their associated outflow boundaries.

Velocity data have been used to determine the direction and strength of the winds over large areas as well as the strength and distribution of winds in thunderstorms. The estimates of surface rainfall are better than expected when compared to actual measurements. The fact that rainfall estimates are available every few minutes over a large area has many applications.

The New Marine Program

The NWS's plans to revamp the marine program will bring better forecasts and warnings. One change will consolidate the High Seas program into a central location. The second part will be to reassign the Coastal Weather Forecast (CWF) responsibility to the new Warning and Forecast Offices (WFO).

The WFO structure allows each office the responsibility for all programs in their given area. This area of responsibility is based primarily on radar coverage and political boundaries. For the Texas coast, four WFOs will eventually cover the area presently covered by the Weather Service Forecast Office (WSFO) in San Antonio. In Florida, six WFOs will cover what is now covered by the WSFO in Miami. The driving idea behind this restructuring is improved service by focusing the attention of a staff of meteorologists at each WFO on a smaller area. Coordination with the user is an important key to the process. The WFOs will be making inquiries to all users concerning NWS products and services.

Finally, adding to the day–to–day forecasts, the WFOs will have responsibility for all the other marine programs in their area. A product called an ***Area Weather Update*** will address the short term forecast over the given office's entire area of responsibility. The WSR-88D will provide critical input in the marine environment. Existing products such as ***Special Marine Warnings and Near Shore Forecasts*** will improve because of the new data and resources that will be available for diagnosing the current situation and formulating a short term forecast.

Other new data sources will also aid in improving NWS products. Soon there will be improved satellite data and automated surface observations in the coastal areas. Ongoing cooperative efforts between federal, state and local government agencies, private corporations and universities are presently providing funds for automated coastal tide and current data platforms. Meteorological data platforms are also being deployed in conjunction with these tide and current data platforms increasing the amount of data available. Because of the increase of information available to the NWS meteorologist, a new weather information processing system will be brought on line in the second half of the 90s. This system will help the forecaster integrate the large amounts of different types of data and improve service to the community.

The National Weather Service is undergoing many changes in the way we do business. The first step, the WSR-88D, has the capabilities to provide many new and useful tools in diagnosing the strength and impact of weather over marine areas. Other changes that will be implemented over the next few years are designed to use new data sources and technologies to allow our forecasters to provide better and more specific forecasts and warnings.

A U. S. VOS Ship pulls off a daring rescue during Typhoon Nat

Typhoon Aquarius

Larry Dickens, Second Mate
LNG ***Aquarius***

ENERGY TRANSPORTATION CORPORATION

Typhoon Nat had been on our weather maps since leaving Arun, Sumatra five days earlier. Now on the evening of September 21st [1991], the weather had deteriorated as we approached from the south of Taiwan. During Nat's erratic travels it had lost some of its punch and was downgraded to a tropical storm. But when it stopped north of Luzon, it rebuilt its strength and was upgraded to a typhoon just a day before we were to pass up the east coast of Taiwan.

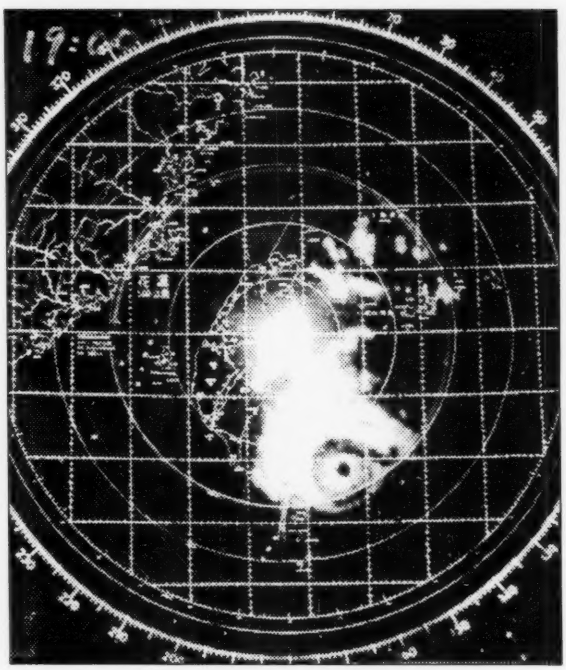
Near Taiwan we encountered rough seas and high winds. When sunset came I posted our lookout on the bridge wing instead of the bow because of the occasionally heavy spray coming over the bow. It was a noisy, windy night, something we had become accustomed to over the years on these seas. When Third Mate Ricky Myles relieved me at 1945 JST (Japan Standard Time), I was temporarily steering 30 degrees off course for crossing traffic.

I went to my bunk and got ready for bed. I had my reading glasses on and was perusing B. Traven's *The Death Ship* when just then there was an announcement over the PA. No more than 10 minutes had passed since I had been relieved when Rick had heard a "Mayday" over the VHF.

An announcement at that hour of the evening is highly unusual; it is used only for emergencies. The work day is done and the ship is quiet and people are sleeping. My first thought was that the traffic situation Rick had inherited from me had dramatically changed for the worse. Perhaps the other ship was suddenly causing a close quarters problem for us.

A few minutes later at 2000, Captain John J. Donahue made an announcement. He warned crew members to be prepared for heavy rolling as the ship was going to turn around to answer a distress call. I quickly dressed and went back to the bridge.

The stricken vessel—the Panamanian-registered ***Marine Future***— was determined to be 20 miles to our south in position 22° 45' N, 122° 15' E. During the short time it had taken me to dress, two other ships were on the VHF with the third mate. The ***MV Novalis*** and the ***MV Primo*** were also responding to the vessel distress call. Later on, the ***Sincere No. 8*** called to say she was also en route to the scene.



The radar at Haulien, Taiwan picked up Nat's concentric rain bands at 2200 JST on the 22nd of September, 1991. The rescue took place earlier in the day when maximum winds near the center were estimated at about 85 knots and on the increase.

The *MV Primo* had actually been in communication with *Marine Future.* Even though we could hear the ships "mayday," we were initially too far away to talk to her. We learned that the *Marine Future* was carrying a load of logs and that her cargo had shifted in the heavy weather. Water was entering two of her holds.

Suddenly while at full speed at 2038, we heard the *Marine Future*'s final transmission—"We are abandoning ship."

By now the *Aquarius'* bridge was starting to become crowded. Third Mate Kelley Stark, Chief Mate John Dorozynski, Radio Officer Frank Allred, and Chief Engineer Don McClendon had arrived on the bridge to help out. Searchlights on both bridge wings and on the bow were rigged and manned. Out on deck, off–duty crew members came out to help. Bosun Tom Brooks and the ship's ordinaries were sent to collect necessary equipment for the rescue. Cargo nets, rope jacobs ladders, extra life rings, and heaving lines were ordered to be brought to both gangways.

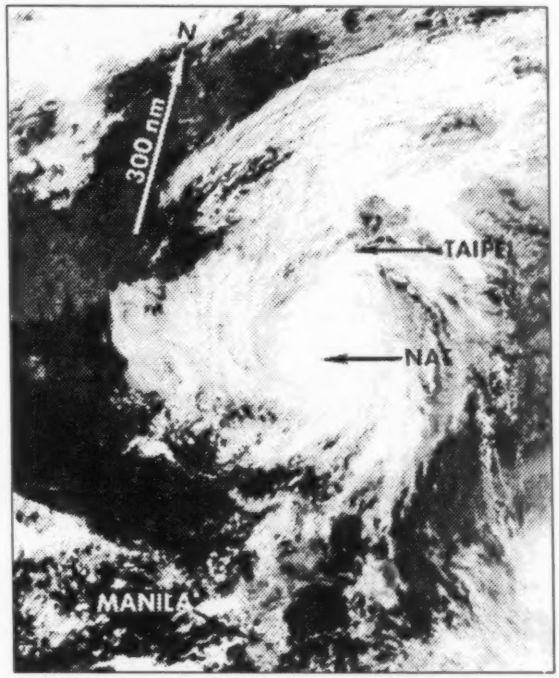
At 2100 we picked up a target dead–in–the–water on radar and on the Collision Avoidance System (CAS). It was about half–point on our starboard bow at 18 miles away. The other three ships responding to the call were on the screen as well. The CAS's main function is to track radar targets and to display their course and speed in the form of vectors. At that time our CAS was a picture of long, fast–moving, glowing lines converging on the motionless target in the center.

At one point, at about 16 miles away, we could see the *Marine Future's* deck light. She had not yet gone down. Her emergency diesel generator was still operating and keeping her deck lights alive.

When we arrived we found the 90–meter vessel badly listing and her main deck awash. Several ship lengths away from the *Marine Future*, a light was spotted in the water. A short distance from her stern another light was spotted. Everyone hoped they were the lights of a lifeboat, a raft or life preserver. At 2148 a parachute flare shot into the sky from the light closest to the stern. The high 44–knot winds quickly took the flare and carried it off to the south–by–west.

Because we were the first ones on the scene, the *LNG Aquarius* was designated the "On the Scene Rescue Coordinator." The *Primo* arrived second, followed by the *Sincere No. 8* and the *M.V. Novalis.* By 2200 the *Aquarius* was maneuvering in an attempt to make a pass at the first light. As we approached the light turned out to be a life raft.

The *Aquarius's* freeboard is over 40 feet high. This provides an enormous amount of sail area which makes it difficult to handle in high winds. As we maneuvered toward the life raft from the west, our



Typhoon Nat crossed southern Taiwan at 1010 JST on the 22nd, nearly a day after the rescue. It was very slow moving at a forward speed of 3 to 5 knots and its center was within 200 miles of Taiwan for several days.

speed was just a little too much—1½ knots. Despite the 29,000 shaft horsepower of the engine's full astern bell, the Force 9 winds prevented us from slowing the vessel sufficiently. The raft bounced off the report side and drifted aft beyond the stern.

At 2219 we started maneuvering for a second attempt to rescue the raft. In the meantime the *MV Primo* had maneuvered through many floating logs and debris toward the raft and by 2300 had a line on it. Ten crew members were rescued shortly afterwards.

With the men rescued and safely aboard, we focused our efforts on the light we had seen closest the *Marine Future's* stern.

While we wrestling with 8–meter seas the *Sincere No. 8* was having difficulties of its own. It reported trouble maneuvering due to its light draft and high freeboard. Captain Donahue released it from the rescue effort, and it continued on its voyage. A third light in the water was reported and Captain Donahue asked the *M. Novalis,* which was standing by, to make an attempt to rescue it while we continued to bring *Aquarius* toward the second light.

That light turned out to be a rigid lifeboat. It was 0046, as we successfully maneuvered alongside. AB Woody Shelton managed to get a line on it by throwing a life ring with a line attached. Once the line was

secured, ***Aquarius*** crew members worked the lifeboat down the starboard side. Maneuvering of the ship's engine aided in bringing the lifeboat beneath the gangway. One by one, the men in the boat grabbed the rope jacobs ladder which hung at the bottom of the accommodation ladder and climbed it. Tied off with safety lines and belts, ordinary seamen Scott Langlois and Angel Reyes were at the bottom of the accommodation ladder assisting the men as they came off the ladder. Several tense moments followed for Langlois, Reyes, and the survivors as the ladder was inundated by wash form the sea.

At 0107 the first man came aboard. By 0110 all 6 men were safely on board. The 3 short minutes it took to get them aboard seemed like an eternity to all of us. The rescued crew member were all tired, but no one needed medical care. All were given hot coffee, sandwiches, cigarettes, beer. They were given warm, dry clothing and shower clogs since none had shoes when they came aboard.

Among the rescued on our ship was the ***Marine Future's*** captain, M. Koda, who informed us that he and his crew totalled 17. Up to this point, a total of 16 had been rescued. We continued to search the water for more lights while we awaited word from the ***Novalis*** on the results of her efforts. Finally, at 0104 the ship reported the rescue of the last crew member. He had been miraculously pulled from the 8–meter sea. He was exhausted and, but for his life preserver, would have died.

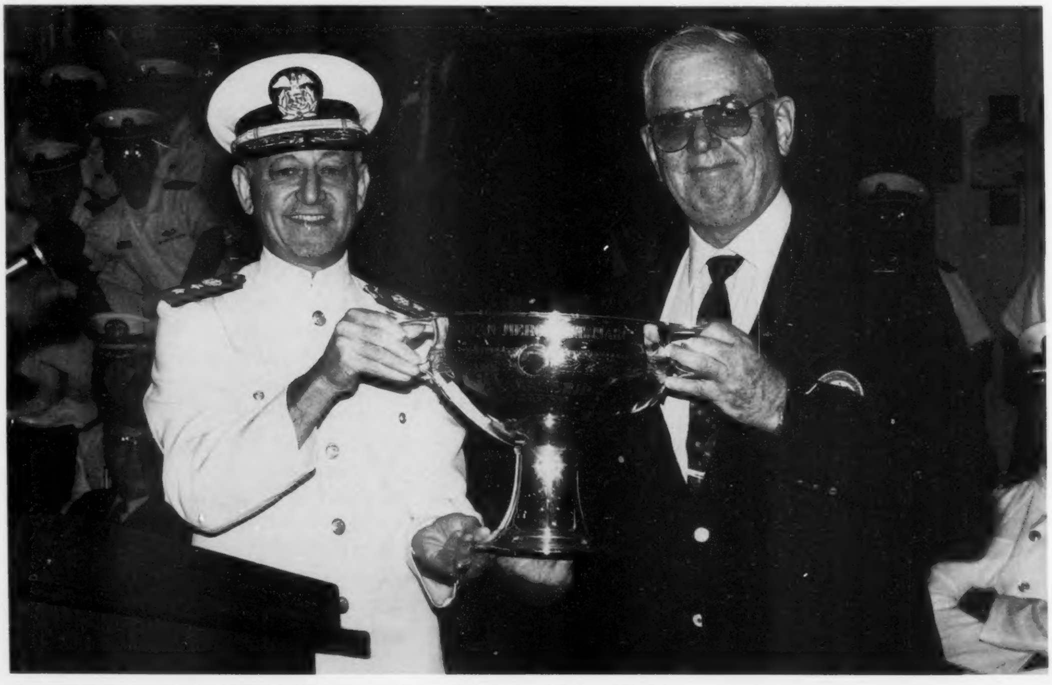
It should be noted here that the incredibly rough sea with its deep troughs had prevented our radars from detecting both the lifeboat and the raft. If it hadn't been for the survivor's use of lights and reflective tape on both craft, we most likely would have never found them until daylight which was six hours away. By then they would have drifted well away from the scene.

All of the *Marine Future's* crew had been successfully saved and, at 0104, all three vessels were released from rescue duty by the ***LNG Aquarius.*** A "very well done" was given to all by Captain Donahue. All vessels then quickly resumed their respective voyages.

American Merchant Marine Seamanship Trophy

Captain J.J. Donahue, master of the ***LNG Aquarius,*** was awarded the prestigious American Merchant Marine Seamanship Trophy for "a distinguished feat of seamanship" in his rescue of the 17 seaman from the ***Marine Future.*** In a ceremony at the U.S. Merchant Marine Academy at Kings Point, N.Y, the silver trophy was presented to him by former Academy superintendent Rear Admiral Paul L. Krinsky. The presentation was the 22nd awarding of the Seamanship Trophy which recognizes extraordinary seamanship and maritime skills by American seafarers.

Recipients of the trophy are chosen by a Select Committee chaired by the U.S. Maritime Administrator and comprised of representatives of maritime labor and management.



American Merchant Marine Seamanship Trophy

Each winner is awarded the trophy for distinguished seamanship and outstanding ship handling.

Awardee/Ship

1962 *Emil "Bus" Mosbacher/**Weatherly***

For a successful defense of the Americas Cup.

1965 *Captain Joseph Cox/**President Wilson***

For the rescue of the crew of the sinking ***Agia Erini L.*** in stormy seas off the coast of Japan.

1967 *Captain Philip Mohun/**American Falcon***

For outstanding ship handling, fine seamanship, and good judgment in saving his ship during a typhoon.

1969 *Officers and crew/**S.S. African Star***

In recognition of the heroic actions of the master, officers, and crew in the ship's collision with an oil-laden barge resulting in a disastrous fire.

1970 *Richard D. Hughes/**Badger State***

A posthumous award made to the boatswain in recognition of his efforts to save his ship from a fire and explosion while carrying munitions to Viet Nam.

1971 *Captain E.A. Olsen/*

For the rescue of seven men from a sinking schooner during a North Atlantic storm.

1972 *Captain C.G. Holmes/**Montana***

For search and rescue of 19 survivors of a sinking freighter.

1973 *Captain G.L. Hollinger/*

For rescue of crew and passenger of the ***M/V Dong*** in extremely adverse weather conditions.

1974 *New York City Fireboat **Firefighter***

For rescue of 30 men in a New York Harbor collision between container ship ***Seawitch*** and oil tanker ***Esso Brussel*** while fighting flames over 10 ft. high.

1975 *Captain Lawrence Pagano/*

For rescue of 14 people including a baby from life rafts adrift on high seas in Marshall Islands in the Pacific.

1977 *Captain Richard A. Fryer*

For the rescue of 31 crew members of the ***M/V Victory Glee***, following the sinking of that ship in the Arabian Sea in June 1976.

1978 *Captain Paul Holland/*

For the rescue of 14 passengers and crew members of the ***Chesapeake Bay*** after their charter boat capsized in a storm, June 6, 1977.

1979 *Captain Glen E. MacDonald*

For rescuing 55 survivors of a National Airlines plane which crashed into Escambia Bay on May 8, 1978.

1980 *Captain Tommie Vizier*

For bringing under control a burning, abandoned vessel outside Galveston, Texas on November 1, 1979.

1981 *Captain Arthur H. Fertig/**T.T. Williamsburg***

For the rescue of over 450 survivors of a fire aboard a passenger ship in the Gulf of Alaska, June 4, 1980.

1982 *Captain John J. Janus*

For the rescue of 10 survivors from a small floundering boat in the South China Sea on June 21, 1981.

1983 *Captain Thomas L. Bayley/**F.V. Kathleen and Julie II***

For distinguished seamanship and personal heroism in locating and rescuing the crew of the ***F/V Robert Powell,*** which had sunk earlier, and personally pulling the survivors from their sinking life raft on December 12, 1982.

1984 *Captain James Brooks and crew/**Casey Chouest***

For distinguished seamanship and gallant crew efforts, under adverse conditions, in attempts to rescue a seaman marooned on a derelict shipwreck in the Gulf of Mexico.

1984 *Captain James "Ed" Bies and crew/**ITB Baltimore***

For search and rescue of 10 survivors form two different doomed sailing vessels during Hurricane Kate in the mid-Atlantic Ocean.

1989 *Captain Joseph C. Mullally and crew/**USNS Sealift China Sea***

For the rescue of 17 Taiwanese crew from the floundering ***Godlen Park*** during a storm in the South China Sea.

1990 *Captain William R. Auld and crew/**Royal Spur***

For the rescue of three seamen from an overturned motor vessel in the the Gulf of Mexico during extremely hazardous weather conditions.

1992 *Captain John J. Donahue/**LNG Aquarius***

For skillful seamanship during Typhoon Nat in rescuing 17 crew members from a sunken cargo ship in the South China Sea.

VOS—Southern Hemisphere

Ian T. Hunter and Chantal Greenwood
Cape Town, South Africa

During the past year, the Maritime Weather Office (MWO) in Cape Town, South Africa has been supplying real-time Voluntary Observing Ship (VOS) data to the South African Data Centre for Oceanography (SADCO) in Stellenbosch. The MWO has been taking the VOS data off the Global Telecommunication System (GTS) on a daily basis since May 1988— from an area extending between 100°E to 100°W and from the Equator to Antarctica.

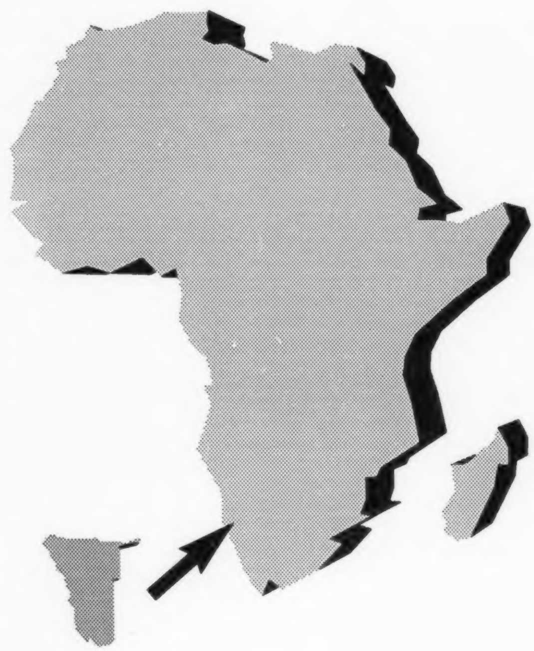
Particular care has been taken to save and correct as many incorrect reports as possible— whether it be an error in position, call sign or meteorological/oceanographic parameter. The MWO has also benefitted from this interaction with SADCO in that free online access to their MARCLIM data base has been made available to the Maritime Weather Office via the Post Office's telecommunications network.

The bulk of MARCLIM's VOS data was obtained from the British Meteorological Office via the South African Weather Bureau. It has been divided into an Active Database (0°–50°E, 0°–70°S) with almost 2 million observations from 1960 to present and an Archive Database which includes the region from 30°W to Greenwich and has observations dating back to the previous century.

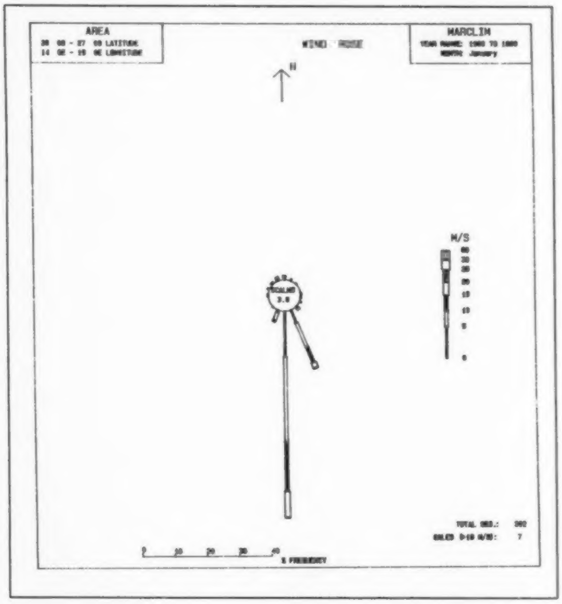
Online access to a data base such as MARCLIM could be of particular benefit to the operational marine meteorologist. Knowledge of past behavior is of obvious benefit to anyone attempting any kind of prediction or in planning a voyage. One of the major problems in many ocean regions is a lack of current meteorological information. The long-term coverage of MARCLIM data is such that some information is usually available even in the more remote areas— to provide a starting point for the forecaster.

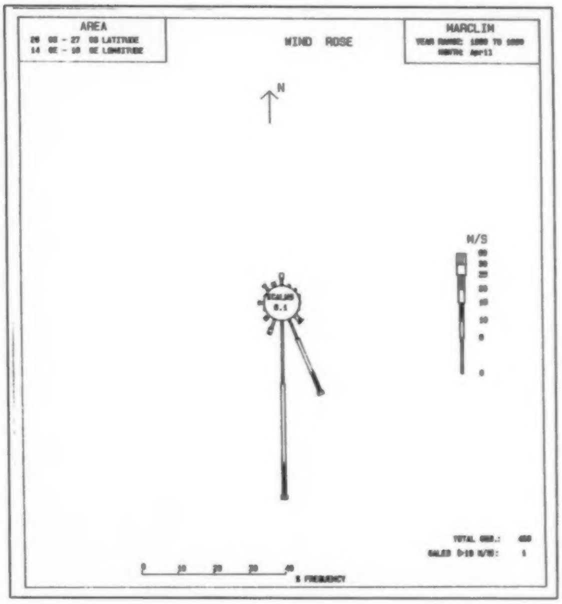
SADCO enables the online user to access its VOS data according to the desired time period and area— and then perform basic statistical analyses on the data set.

The wind roses on page 21 were prepared for an area off Namibia, in southern Africa, in the waters adjacent to Luderitz. They are based upon relatively few observations, since the region is inshore of the normal trade routes and because coastal observations are notoriously the most difficult to come by. However, the summaries provide the forecaster with a guide to wind conditions and are a good example of the importance of ship observations. In addition to these summaries, the observations can be used to study extreme conditions and various combinations of parameters. MARCLIM has also been used in the past to provide information on swell direction, so often lacking for design purposes. The VOS observations are used in more ways than the mariner could imagine and ultimately are returned to him in a safer passage at sea. They are much appreciated!

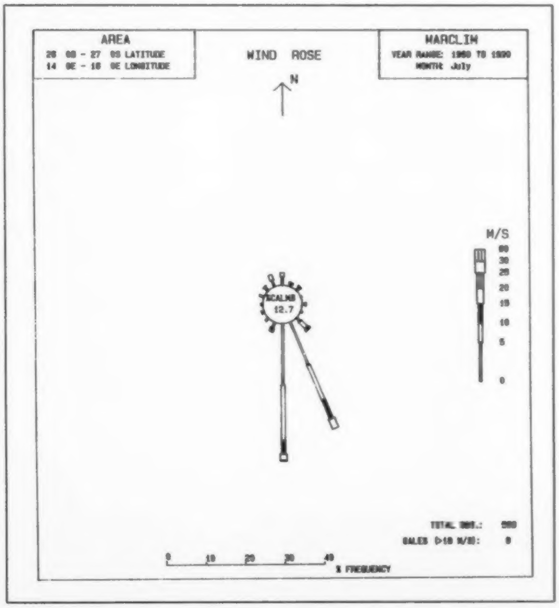


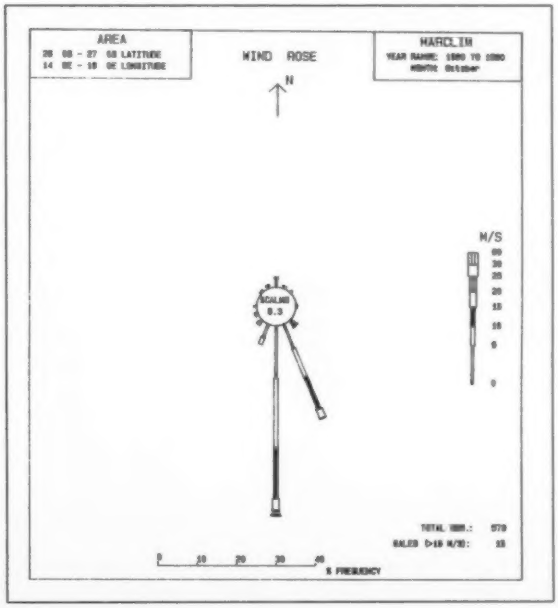
Namibia





These wind roses provide some insights about the winds off Namibia. The dominant wind is southerly, and the southwesterly component is not nearly as prominent as the land-based observations suggest. This discrepancy is due to a weakening sea breeze component toward the open ocean. The southeasterly component reaches its peak in winter as the land–sea temperature differential decreases. According to the land-based winds statistics (Diaz Point Lighthouse), January is the month most likely to produce winds of gale force and higher. The occurrence of strong wind conditions decreases markedly offshore—again due to the weakening sea breeze effect. Note that this coast boasts one of the most intense upwelling regions on the globe, with sea surface temperatures of under 10° C occurring in the middle of summer at 26° S latitude (that's comparable to a water temperature of less than 50° F at Miami). Furthermore, air temperatures may rise to above 40° C a short distance from the coast in all but the coldest months. The number of calms offshore reaches a peak in winter, which is in agreement with the inshore statistics. The low sea surface temperatures make for a very stable boundary layer condition so that it is not unusual to have a surface calm overlain by strong winds a short distance above the water.





SAR: A New Ice Analysis Tool

Franklin E. Kniskern
Ice Analysis Branch, National Ocean Service

The ice analysts at the Navy/NOAA Joint Ice Center (JIC) are experimenting with a new "tool" for ice analysis. The Synthetic Aperture Radar (SAR), which is aboard the European Space Agency's environmental satellite ERS–1, provides images which are especially valuable for observing ice. Unlike visible and infrared images which are contaminated by clouds, the SAR is an all–weather sensor which makes it particularly useful for observing ice in the cloudy, polar regions.

A SAR workstation has been installed at the JIC to display the SAR images in the 240 meter standard low resolution images. Hardware and software have also been installed to conduct an operational demonstration of the utility of the SAR data for ice analyses. A SAR communications system, known as SARCOM, was developed by the Naval Research Laboratory to transfer SAR data from the Alaska SAR Facility (ASF) in Fairbanks, Alaska to the JIC.

The workstation presently includes software that automatically classifies sea ice type and determines sea ice motion between image pairs. Once a basic product is created, the user can apply several graphic applications to annotate, color, code, affix a map grid, draw a ship route and draw ice boundaries.

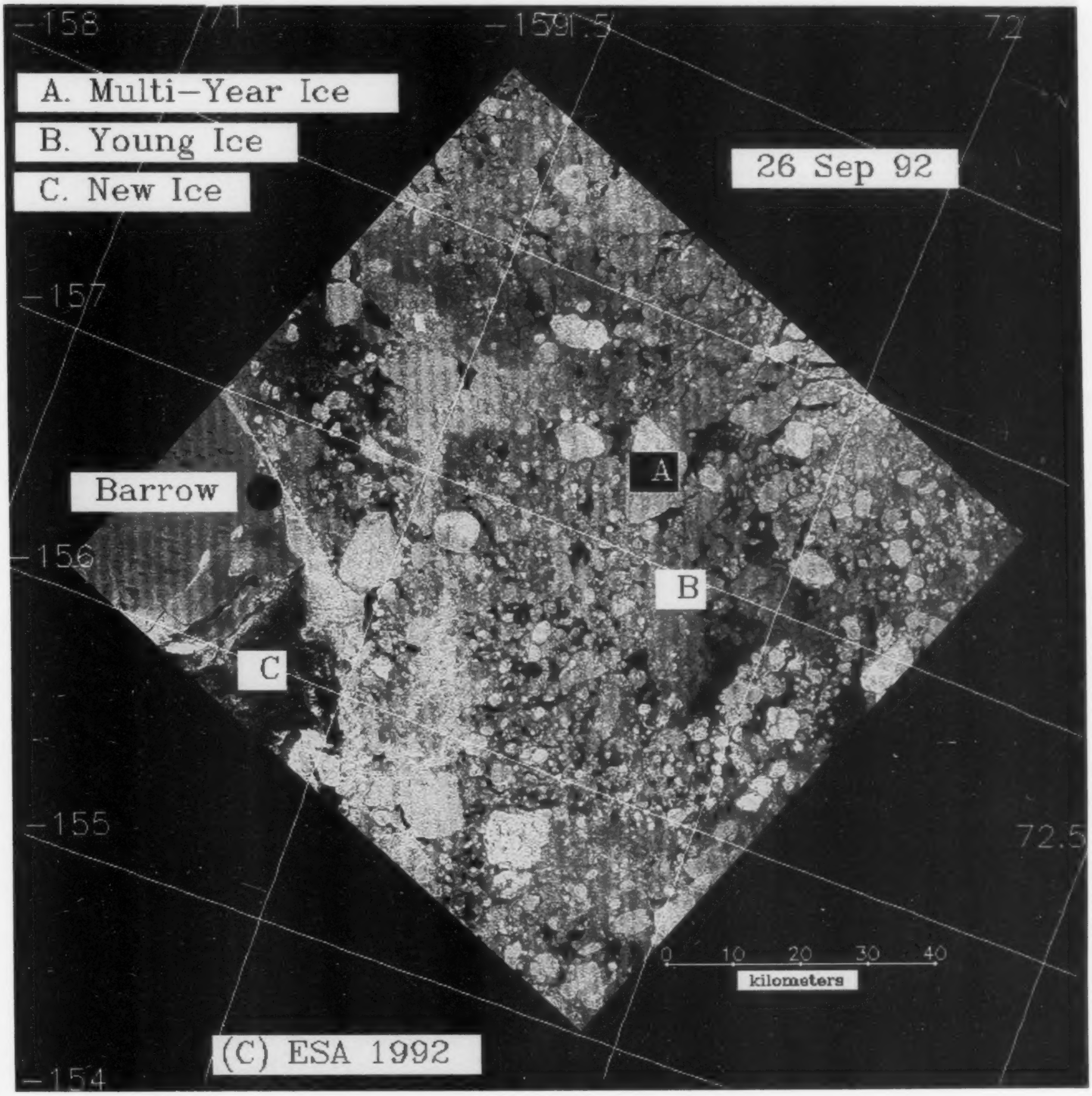
The accompanying photograph shows a typical 240–meter resolution, SAR image off the coast of Point Barrow, Alaska for September 26, 1992. New ice, which appears rather dark in the image, is forming along the coast of east of Point Barrow as freeze–up is starting to occur. Note how vivid the multi–year ice floes appear in the SAR image. SAR data should be extremely useful in routing ships through ice infested waters and determining the boundaries between multi–year and first–year ice.

Although analysts at the JIC, who must produce global and regional ice analyses and forecasts, are very excited about the SAR images, only a limited amount of SAR data is available in near–real time. Since no recording capability is available on board ERS–1, only SAR images from the seas surrounding Alaska are received from the ASF. In early 1993, the JIC will exchange SAR images with Ice Centre Environment Canada (ICEC) over a communications link between the two ice centers. Thus, the JIC will receive some SAR data covering the Great Lakes and the Labrador Sea from the SAR Facility near Ottawa.

SAR demonstrates great promise as an instrument for sea ice analysis. However, there is still much to learn about the capabilities of SAR. During the next few years, the JIC will continue to use visible and infrared imagery operationally for their ice products as they continue with the demonstration of SAR and gradually validate this potentially useful data source.

This new development also serves to highlight the fact that no matter how far we advance there is still an important need for ship weather and oceanographic observations. This will be the case for some time to come. These new technologies are also dependent for evaluation on the VOS observations. Ice in particular is a critical parameter and a plea for these observations in the North Atlantic can be found in the *Tips to the Radio Officers* column in this issue.

Image ID:	**32445Q0101**	**Sensor:**	**ERS-1**
Center Time:	**1992:270:22:07:56.285**	**Image size:**	**102.4 km (azimuth)**
Center Location:	**lat 71.69 lon -156.89**		**99.1 km (range)**



The Lone Star Lights

—Elinor De Wire

Southern sentinels, particularly those in the Gulf of Mexico, have never enjoyed the same public acclaim given New England's old lighthouses. Tall ships, smokey port taverns, crowded wharves, and majestic masonry lighthouses seldom conjure images of Texas. Yet many of the Gulf lights bear striking resemblance to traditional Yankee towers. They too have served long careers in perilous places, ably tended by men and women of inimitable spirit.

Texas, with 400 miles of hurricane-battered, shoal-riddled shore, could rival any of our nation's coastal states for the grim title, "Graveyard of Ships." Lighthouses were very much a part of Texas history long before its bronze sands were turned black with oil and the skeletal profiles of derricks stood along its shores.

No roads led into Texas in the early 1800s, only cow paths and tribal trails. Pioneers and land speculators came by ship, dodging shoals and searching for the few known landmarks among the look-alike barrier islands that form a protective ribbon along the shore. Despite inadequate charts, a host of coastal hazards and savage storms, ports were built, and the cry went out for lighthouses.

Sam Houston, one of the early founders of the state, lobbied for navigational aids in 1845. Although two lighthouses were planned in 1847 at Galveston and Matagorda Bays, impending statehood and government reorganization of the Lighthouse Service held up construction. An unexplainable air of indifference to the Gulf of Mexico, seemed to be expressed by the overseer of the nation's navigational aids. Stephen Pleasanton appeared more concerned with New England and the Great Lakes even though the South was burgeoning. Only the Mississippi River received serious consideration.

By 1851 the newly formed Lighthouse Board acted and a year later a cast-iron lighthouse was built at Bolivar Point along a sultry plain where cranes and herons took measured steps in the marshes, and sea oats rocked to and fro in the Gulf Breeze. Painted red, it became a distinctive daymark against the low, flat beaches and beige sands of the Gulf Coast. Other lighthouses soon followed, and by 1859 a necklace of lights outlined the Texas shores extending from its Sabine River border with Louisiana to its southern limit at Brownsville.

Bolivar Lighthouse was fabricated in Baltimore by the iron company of Murray and Hazlehurst, then shipped in pieces to the Texas coast and assembled on its foundation in 1852. It would be the first light ships would see on the approach to Galveston. At the same time the company also built Matagorda Lighthouse. The price tag for the two sentinels tallied at $23,400. Both lights were fitted with Boston-made 21 inch silvered reflectors and lamps—archaic for the time considering Europe had been using the revolutionary Fresnel lenses for two decades. A wooden keeper's dwelling completed the Bolivar station, and it was lit shortly after the New Year in 1853.

As with many engineering projects in a growing territory, Bolivar Light was almost immediately rendered inadequate by the influx of settlers and commercial interests on the frontier. The old lighting system was feeble, and the tower was too short to meet the needs of

The Bolivar Light was first authorized for Galveston Island in 1847, but the following year was changed to Bolivar Point, across the entrance to Galveston Bay. The second tower finished in 1872 was built under difficult circumstances. By 1870 Yellow Fever had reached epidemic proportions and the area between New Orleans and Galveston were under a strict quarantine. This temporarily halted construction. Then after failing to obtain a new site, construction began on the old site, but money ran out when the brickwork reached 40 feet of its intended 116 feet. The ironwork and lens lay on the sand until addtional funds were obtained.

increased shipping. The same company that had fabricated and built the light returned in 1857 to heighten it an additional 24 feet and to install a third-order Fresnel lens.

Three years later the light was extinguished by Confederate soldiers to prevent it aiding the enemy Union. As a further assurance, the entire lighthouse was taken apart, plate by plate, and hidden. Historian T. Linsey Baker believes the plates were eventually melted down to manufacture war materials for the Confederacy.

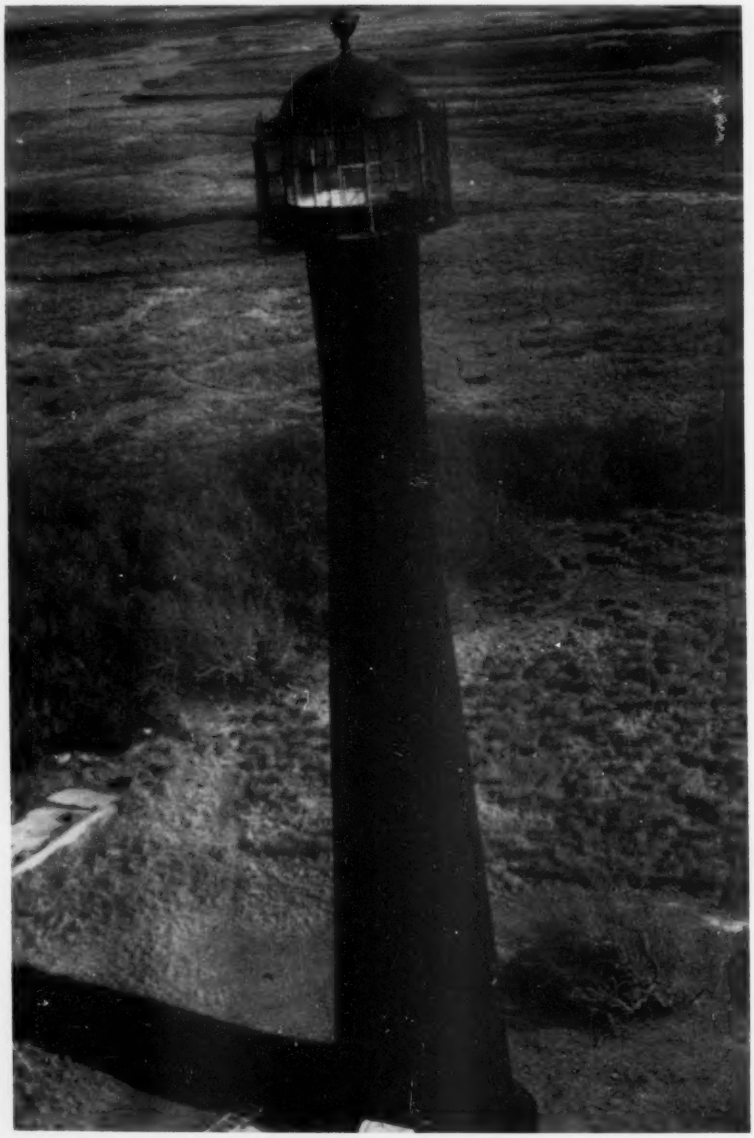
A temporary wooden beacon went into service after the war and served until 1872 when a new cast iron tower was built. This new tower was modeled after the handsome Pass a' Loutre Lighthouse in Louisiana and sported a black and white banded daymark and a brilliant third-order, fixed Fresnel lens. The lens was upgraded to a second-order flashing beacon after shipping increased and mariners began to complain that the lighthouse could not be seen at a great enough distance.

Life at Bolivar Light was hardly idyllic. Nothing would grow in the sand around the tower, so keepers spent much of their time rowing to a nearby settlement for food, which had to be nonperishable because of the Texas heat. Mosquitoes were thick and soiled the lens and the brass work. Birds crashed into the tower frequently and sometimes took refuge in the lantern if a cold snap, locally known as a Blue Norther, set in. And the heat and humidity could be oppressive on summer days when the Gulf breeze died down.

Henry Claiborne served at Bolivar Light through two of the most destructive Texas storms. The 1900 hurricane struck on Septem-

ber 7th and 8th, inundating Galveston and its surrounding shores with a monster storm surge and estimated 120–mph winds. The lighthouse proved to be one of the most stable structures in the area in spite of its height. The homeless took refuge inside it, welcomed by Henry Claiborne and his wife, who fed her frightened guests a meal of boiled beans. Before the storm ended, 124 people clambered onto its spiral stairs, two on a step, while in the bottom the water had risen to the chest of the lowest person. Keeper Claiborne stood watch in the lantern throughout the storm and at times was forced to cling to handholds to keep from falling as the 117–foot tower reeled in the gale.

Fifteen years later another powerful hurricane hit the Texas coast. Keeper Claiborne reported to the Bureau of Lighthouses that the 1900 storm paled in comparison. A description in the October 1915 *Lighthouse Service Bulletin* read: "The water, he [Claiborne] says, was considerably higher and the wind prolonged to almost four times the length of the 1900 hurricane. In the storm of that year none of the light station houses were wrecked, whereas in the recent storm all structures save the residence of the keeper were swept away, and even that building was damaged."



The 1915 cyclone tore the keeper's house from its foundation and tossed it into a pit that the sea had gouged out farther down the point. Many other buildings disappeared in the surge. Once again only the lighthouse remained, a sanctuary for dozens of local residents who had lost their homes.

Assistant Keeper J.P. Brooks stood watch in the lantern as the hurricane made landfall on the night of August 16. He reported that when the revolving mechanism of the light failed about 9:15 p.m., he was forced to turn it by hand. He remained in the lantern until the storm threatened to shatter the windows, then he trimmed the wicks and left the light shining. As he descended the stairs, stepping over the frightened people, he felt wind howling up the shaft of the lighthouse. The iron door at the base of the tower had come open, and water had risen some six feet high. Fearing that the erosive force of the water would undermine the lighthouse foundation and topple the tower, Brooks tethered himself with a rope and jumped into the seething cauldron at the bottom. After several attempts he managed to secure the door.

The Matagorda Light (left) suffered a fate similar to Bolivar Light during the Civil War, although it was not dismantled until 1867 when it was in danger of falling. It was rebuilt on a different site in 1873. The brick lighthouse at Aransas Pass (above) was damaged in the Civil War. The top 20 feet, split by explosives, had to be removed and rebuilt in 1867.

The tower light was relit when the floodwaters began to recede the following day, but the beacon did not burn for two days following the storm because there was no oil. The tidal surge had swept away the oil tanks, and it was several days before a boat from Galveston could re-supply the lamps.

Two new keeper's homes were built following the hurricane, this time perched on stilts to allow floodwaters less opportunity to demolish them. Life resumed as usual until a year later when something entirely unexpected happened. On a quiet November afternoon in 1917, Keeper Claiborne was astounded when shells began bombarding the lighthouse compound. The shelling continued for about two hours.

"One 3–inch shell struck the front of the Tower making a 3–inch hole through the steel plate a little above & to the eastward of the entrance door," Claiborne reported.

The Coast Guard investigation discovered that soldiers from nearby Fort San Jacinto had been conducting gunnery practice with what they thought were weakened powder charges.

In 1907 Bolivar Lighthouse was downgraded to a third-order harbor beacon, since the new Galveston Jetty Light better served the needs of shipping nearer the channel entrance to Galveston Bay. When the younger and more proximate sentinel was increased in brilliance in 1930, the Bureau of Lighthouses announced that Bolivar Light would be abandoned. Barraged with protests from local residents, including a prominent Congressman, the government backed down. The Depression years forced the government to reconsider the necessity of keeping a beacon lit for the sake of sentiment and in 1933, the light was extinguished.

For a few years the Army at Fort San Jacinto used the lighthouse as an observation tower. After World War II, it was auctioned off. The buyer, E.V. Boyd, purchased the station for $5,500 and converted it into a summer vacation retreat. It still remains in the Boyd family today.

The tower's magnificent third-order lens was given to the Smithsonian Institution's National Museum of American History and is currently on display in the maritime industry hall.

About a dozen Texas lighthouses remain standing today. Each is, in the words of lighthouse historian F. Ross Holland, "a window on the past."

Depression Era Great Lakes Sailor

George Bennett with Skip Gillham

On an early spring morning during the Depression, George Bennett remembers cycling around Port Dalhousie harbor in St. Catharines, Ontario, Canada. When he spotted the winter fleet near the entrance of the Third Welland Canal, he asked if any work was available. The Captain of the ***John J. Boland Jr.*** told Bennett that a deckhand was expected at 4:00 p.m., but if the man didn't show up, the job was his. That's how Bennett landed his first job aboard a steamship.

He convinced his reluctant mother and had his father take him back to the ship where the Captain assured him that he would keep an eye on his young son.

The ***John J. Boland, Jr.***, a Great Lakes canaler, was built at Wallsend, England in 1928. The 258–foot long vessel was the standard size of many of the sturdy ships constructed for travelling through the confining locks of the pre-Seaway St. Lawrence canals and the Third Welland Canal.

Because it was considered bad luck to start a new sailing season on a Friday, the ship set sail shortly after midnight on the 16th of April 1932. The ***Boland*** headed for Port Weller, the entrance to the Fourth Welland Canal, and awaited its turn for upbound passage. Its crew numbered nineteen: Captain Hawman, two mates, two wheelmen, two watchmen, three deckhands, chief Engineer, 2nd engineer, two oilers, three firemen and two cooks. Wheelmen and oilers received all of $55 per month, firemen $50, watchman $45. Deckhands, expected to be on call 24 hours a day, earned $40. All received free room and board. The ship's rules were simple: no alcohol, no women, and no union organizers.

Bennett's first stop was Erie, Pennsylvania where about 3,000 tons of coal rattled aboard in a 4–hour span. The payload was delivered to Hamilton and the coal was unloaded over a 24–hour period. The ship continued on to Cleveland and another shipment of coal.

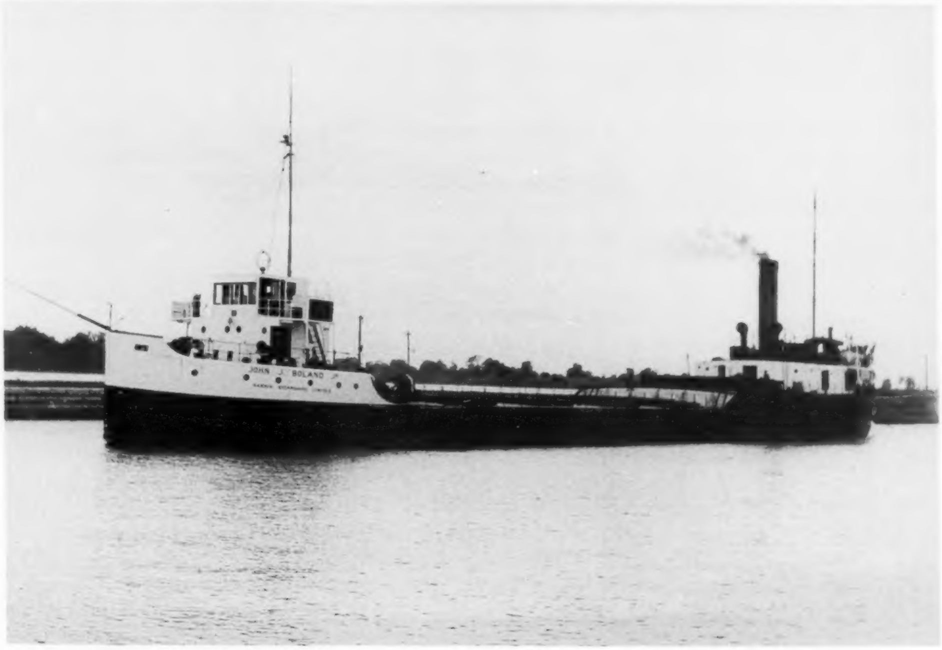
With the canalling and quick turnarounds, Bennett recalls it was 3 days before he and the crew could change their clothes. Any rest they could grab was on a "crash" basis.

During the season, loads of coal, grain, and pulpwood from Buffalo to Montreal kept the ***John J. Boland, Jr.*** busy. Loading pulpwood was a painstaking job as the logs had to be piled in the holds and on deck to maximize the use of space. The corners were crisscrossed and nailed with wooden cleats. Heavy weather could threaten the deck cargo. One memorable storm occurred in Long Point Bay on Lake Erie while the ***Boland*** was hauling pulpwood to Erie.

On October 4, 1932, the crew filled its cargo holds with coal and then piled more on deck until the ship came down to the maximum draft. No protective tarpaulins or hatch covers were fitted, but this was not unusual for the short, cross-lake run to Port Colborne and the Welland Canal.

The weather was calm when the weary deckhands went to sleep. Lake Erie, the shallowest of the

*George Bennett survived the sinking of the **John J. Boland, Jr.** (right) in a storm in 1932. Four crew members were not so fortunate. Photograph from the Earl Simzer Collection, courtesy of George Ayoub.*



Great Lakes, is known to whip up furious wave action in a short period of time. By the time the crew were awakened at 3:00 a.m. on the 5th, a strong southwest wind had picked up, and the seas were washing over the deck from the port quarter.

The deck crew struggled to stretch tarps over the coal piled on deck and to protect the open passage to the hold. Each new wave washed their efforts away. Soon the barrier of coal was cleaned off the port side by the steady onslaught of waves, and the cargo hold was unprotected.

Captain Hawman tried to turn into the wind and run for the lee of the American shore, but the ship would not respond. In the early daylight, only the port lifeboat could be lowered as the list was too great on the starboard side. The crew threw hatch covers to those escaping. The port lifeboat overturned, but four sailors managed to hang on. The First Mate picked up the crew, and Bennett was lucky enough to be one of the first. Gradually, others were pulled aboard. Of the crew of nineteen, four were lost. The ship soon rolled over bottom up but remained afloat for almost 30 minutes.

The survivors estimated that they were 20 miles from the U.S. shore. With seven or eight oars and a sheet of canvas over the small boat, they reached shore in about 6 hours but could not turn in for fear of being swamped. They eventually landed near Westfield, N.Y., only to discover that the shore was rimmed by a high cliff. Exhausted, they walked the boat about a mile before they discovered a way up.

Bennett recalled hiking across a field and down a road to a gas station where the crew called the Sarnia Steamships office. A bus was sent and much to their surprise a large number of reporters waited for them when they arrived. Some of the crew said that the ship had turned in circles before it sank, but Bennett denies that this was the case. These imaginary accounts likely contributed to the belief that the ***Boland*** had rudder problems before it sank.

The Company asked each man to list what clothing they lost. Bennett asked for a replacement of a suit of long underwear and in return they sent him a new dress suit. During the winter of that year, there was an investigation of the sinking of the ***Boland***. As a result, Captain Hawman lost his license for one year, and the practice of allowing deck loads with open hatches was ended.

In 1933 Hawman shipped out as First Mate on the ***Fairlake***, a 1929 vintage canaller. Bennett joined him in the same year as Watchman, although he was eager to learn steering so that he could advance to a Wheelman position.

As Watchman, Bennett. worked an 84-hour week with no overtime—6 hours on and 6 hours off.

Watchmen usually spent 6 hours on the fore deck or in the wheelhouse. Their job was to relieve the wheelmen, sound the bilges regularly for any sign of water, handle the winches when canalling or docking, keep the galley stove going, and wake the cook at 5:00 a.m. Bennett hated the task of patching the tarpaulins that covered the hatch, a job requiring strong thread and heavy gloves with a metal pad in the palm to prevent injury.

Still, life aboard was not all labor. Practical jokes were common. Bennett's favorite involved teasing rookie sailors. The rookie would be convinced that there was a great rush to get to Montreal, and he could be of help. As soon as they cleared Port Weller, the unsuspecting man was told he would be given a file and lowered over the bow of the ship. His job would be to sharpen the stem so it would cut the water better and improve their speed. Lucky for the young sailor, the Captain would sense trouble and put an end to the joke, and the plotters would scatter.

Bennett's good luck continued on the ***Fairlake***. On watch one night in dense fog, Bennett heard the signal of an approaching vessel and was sent up the mast for a better view. Out of the mist, the ***Lady Summers*** appeared on a collision course with the ***Fairlake***. Not soon enough for Bennett, both ships pulled to their starboard and passed safely within jumping distance of each other's decks.

Bennett continued to work on the Great Lakes for a number of years. He sailed with the ***Riverton***, built in 1896 as the ***L.C. Waldo***, a ship once stranded on Gull Rock, Lake Superior by the famous November 1913 storm. This new job meant no deck work, but when in port he had to polish brass, wash windows, and keep the shaft clean and oiled. With tough economic times, the ship was often laid up, but the crew was allowed to remain aboard as they waited for cargoes. Their pay ceased, but they were given room and board in exchange for 4 hours per day of work. This included chipping and painting, suggying and tarp repair. Two others earned their keep by maintaining the watch.

George Bennett briefly came ashore after the 1934 season, married and became a father before he went back on the boats in 1938. He contacted his old friend Captain Hawman who arranged a wheelman position aboard the 400–foot long bulk carrier ***Anna C. Minch***, built by the American Shipbuilding Company at Cleveland, Ohio in 1903.

In 1938 Bennett left the Great Lakes and spent the rest of his working career at McKinnon Industries (General Motors) of St. Catharines.

Bennett's good luck becomes more apparent when his ships' histories are known. The ***Anna C. Minch*** disappeared with all hands in the Armistice Day Storm on Lake Michigan only 2 years after Bennett returned to land. The ***Riverton*** was stranded on Lottie Wolf Shoal, Georgian Bay in November 1943 only to finally sink off the coast of Genoa, Italy in 1967.

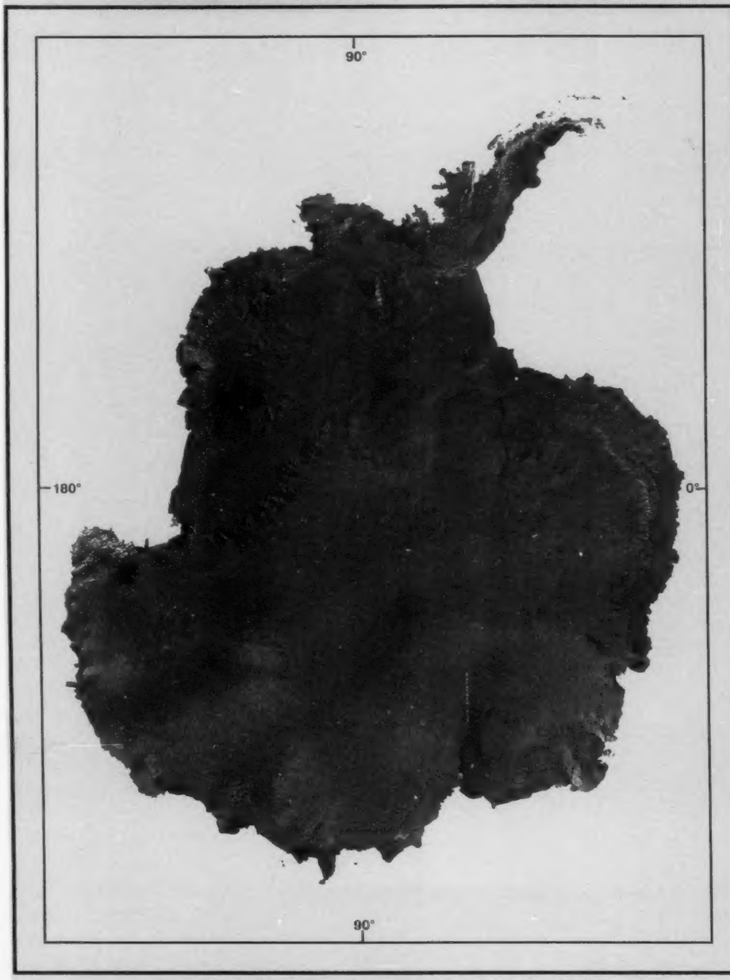
George Bennett may well be the last surviving member of the crew of the ***J.H. Boland***. With the 60th Anniversary of the vessel's loss, it seems appropriate to share the reminiscences of a Depression era sailor who sailed the Great Lakes.

After the John J. Boland Jr. cleared Port Dalhousie, it headed for Port Weller the entrance to the recently completed Fourth Welland Canal. Work on the construction of the Fourth Welland Canal is seen above. Courtesy of St. Catharines Historical Museum.

Does DMA use NOAA Satellite Photos?

Howard Cohen
Defense Mapping Agency

SATELLITE IMAGE MAP OF ANTARCTICA



Prepared by the United States Geological Survey in cooperation with the National Oceanic and Atmospheric Adminstration and the National Remote Sensing Center, England with support from the National Science Foundation.

For the first time in mapping history, the Defense Mapping Agency combined forces with NOAA to incorporate satellite imagery in creating maps for mariners. The overall project was initiated in DMA's Navigation Publication Branch, headed by Kevin Hayes who believes that mariners will respond enthusiastically to coastal views from space.

The DMA's publication, *Sailing Directions* provides views of coastal areas that vessels travel, information about ports, and supplements information seen on charts. Their coastline and harbor views were customarily taken at sea level or from low–flying aircraft.

The first NOAA and DMA collaboration appeared in Publication 132, *Sailing Directions Enroute for the Eastern Mediterranean.* The composite view was made possible by NOAA's Advance Very High Resolution Radiometer (AVHRR) satellite.

NOAA's Satellite Data Services Division is a unique source of information for the public. Daily, hundreds of images are received from Earth–watching spacecraft by the Division. Currently, there are over 5 million separate images and 150,000 computer compatible tapes that are archived.

John Tohma, of Satellite Data Service Division in Camp Springs, MD, provided both technical assistance and enthusiasm for the DMA/NOAA project.

"We are glad to be of service. Seeing the finished product is always a great pride and joy to NOAA staff," said Tohma.

A later DMA publication offered new views of Antarctica, one of the greatest land masses in the world. Satellite imagery provided a mosaic view for DMA's Publication 200, *Sailing Directions (Planning Guide and Enroute) for Antarctica*, 2nd edition. Twenty-five satellite images taken from the AVHRR instrument that flew on several NOAA Tiros polar-orbiting satellites were used. The view of the frozen continent includes visible, near-infrared, and thermal data, and has a resolution of 1 kilometer. The Ross Ice Shelf (center right) and the South Shetland Islands (off the peninsula, middle right) are clearly visible.

The Antarctic mosaic was supplied to DMA by the United States Geological Survey in cooperation with NOAA and the National Remote Sensing Center in England and with support from the National Science Foundation. Since the first sketches of a coastline appeared in the mid 19th century to satellite views today, NOAA and DMA continue to lead the world in combining the latest technology and information to better serve its users.

NOAA SATELLITE VIEW - EASTERN MEDITERRANEAN

PILOT CHARTS ATLASES

Notice to Mariners 41/91 explained the new configuration of pilot chart atlases and the discontinuance of the quarterly pilot charts. The second edition of NVPUB 106, *Atlas of Pilot Charts for the North Atlantic Ocean* is ready for issue. It contains the full 12 months of the former quarterly Pilot 16, *Pilot Charts of the North Atlantic;* the former NVPUB 108, *Atlas of Pilot Charts for the Northern Atlantic*; the former NVPUB 106, *Atlas of Pilot Charts for the Central American Waters.* These are arranged as sections I, II, III of the new atlas for easy reference. This new edition therefore combines all the North Atlantic pilot chart data into one atlas.

The former NVPUB 108, *Atlas of Pilot Charts for the Northern North Atlantic* will become NVPUB 108, *Atlas of Pilot Charts for the North Pacific Ocean.* This edition will be ready for issue in 1994, and until it is announced, previous copies of the quarterly North Pacific Charts can be used without hesitation since the environmental data is the same. Each subsequent atlas will be published two years after the last over a 10–year cycle. Since the climatic data use to compile the pilot charts is averaged over several decades, a 10–year publishing cycle is appropriate. The next climatic data set which could affect the pilot chart data will be ready in 1996, and subsequent atlases will reflect the new data. Geomagnetic data is updated in 5–year intervals, with the latest epoch being 1990. Pilot Chart articles are planned for each atlas.

The following list summarizes the new pilot chart inventory:

Stock #	Title	Edition	Scheduled Date
NVPUB 105	*Atlas of Pilot Charts South Atlantic Ocean*	2nd	1996
NVPUB 106	*Atlas of Pilot Charts North Atlantic Ocean*	2nd	1992
NVPUB 107	*Atlas of Pilot Charts South Pacific Ocean*	2nd	1998
NVPUB 108	*Atlas of Pilot Charts North Pacific Ocean*	3rd	1994
NVPUB 109	*Atlas of Pilot Charts Indian Ocean*	4th	2000

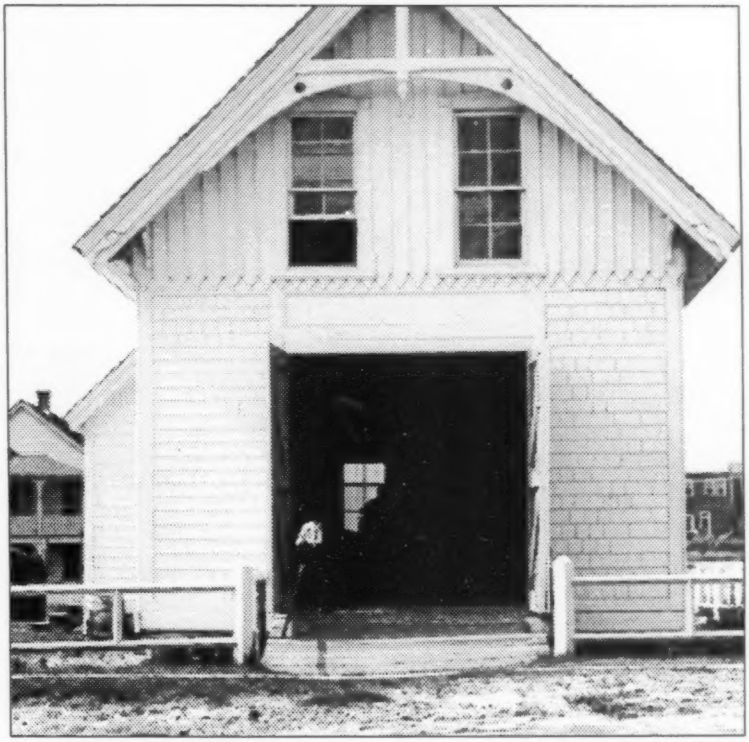
Virginia Beach Lifesavers

Elinor De Wire

When the U.S. Life–saving Service was officially established in 1878, two lifesaving stations were in operation in Virginia—Cape Henry on the southern entrance to the Chesapeake Bay and Dam Neck Mills, just south of the sparkling sands of what is today Virginia Beach. To close the unguarded gap between these two stations, the Seatack Life–saving Station was established.

Lifesaving historian Wick York believes the name Seatack derives from a British "sea attack" that was launched on this stretch of beach during the War of 1812. Thereafter, people began referring to the area as "sea attack" and eventually shortened it to "seatack."

The keeper and crew of surfmen who ran this station conducted beach patrols on foot along the lengthy expanse of sand. The area was pristine and uninhabited in those days. The tall hotels, boardwalk, restaurants, and shops that came to attract tourists by the millions in the 20th century were only a dream in 1878. The men of



Lifesaving Museum of Virginia

The original lifesaving station at Virginia Beach was built in 1879 as Station Number Two in a chain of coastal rescue stations that the United States Life–Saving Service operated in its Sixth District, which has jurisdiction over lifesaving stations in Virginia and North Carolina. Station Number One was located ¼ of a mile southeast of Cape Henry Lighthouse, while the Seatack station was 5 miles south of the light.

the Seatack station did not regard the beach as a sun-blessed strand suitable for sunbathing and relaxation; rather it was to them a wrathful stretch of shore for shipping and a staging point for many difficult rescues.

The first of these rescues was carried out within weeks of the station's opening when the schooner ***A.S. Davis*** went aground north of Seatack in a violent hurricane. The surfmen were unable to launch the lifeboat or fire a lifeline. Only one man survived. Coming ashore naked from the raking surf that had torn the clothing from his body, he took shelter behind a dune until a surfman from Seatack discovered him the next morning. Nineteen others from the ***A.S. Davis*** drowned.

It was a grim baptism into the harsh and sometimes exasperating affairs of a lifesaving station, but the surfmen of Seatack would have many other opportunities to save lives. In March 1891 they came to the rescue of the crew of the Norwegian bark ***Dictator***, on its way to Norfolk for repairs and carrying a heavy cargo of timber. After rounding the Florida Keys on March 12th, the ***Dictator*** ran into a fierce storm. When it passed Grand Bahama Island on the 19th, another storm blew in and the vessel, which was already riding low in the water, sprang a leak. The pounding continued as the ship ran into a hurricane on the 23rd. This constant punishment took its toll and the ship went aground over a mile from the Seatack station, which meant that the surfmen had to make a difficult trek over the sand towing the beach cart and carrying heavy equipment. The station's horses, shod in broad and heavy metal to help them over the soft beach, pulled the boat carriage.

Rough seas and strong winds hindered the rescue effort, but 10 of the 17 aboard were saved. Among those lost were the captain''s wife and son who had attempted to swim ashore in the darkness.

As seagoing vessels increased in size, and powered propulsion changed the nature of rescue operations, the need for a larger and more modern station was recognized. In 1903 the Seatack Life–saving Station was rebuilt closer to the beach, which had extended itself seaward somewhat since the establishment of the original station 25 years earlier. Only 3 years later the Town of Virginia Beach was incorporated, and the lifesavers found themselves in the midst of a small, growing hamlet of friendly and supportive neighbors.

The year 1915 brought a drastic change to Seatack when the Revenue Cutter Service was merged with the U.S. Life–saving Service to form the U.S. Coast Guard. The men of Seatack adjusted well, donning the Coast Guard uniform and embracing a new motto: *Semper Paratus*–"Always ready." It was a much more comforting maxim than the one they had been carrying for decades: "You have to go out, but you don't have to come back!"

The mission of the new Seatack Coast Guard Station remained much the same except that more duties were assigned to the men. Their abilities as rescuers extended beyond shipwrecks, often requiring them to keep watch for enemy vessels during wartime or to operate the Navy's radio direction finder and the Coast Guard's new amphibious rescue vehicles. Sometimes they were even called to assist at fires in town.

With shipwrecks on the decline after World War II, the importance of the Seatack Coast Guard Station ebbed. Nevertheless, the station survived until 1969. When its ensign was lowered on decommissioning day, it had served the Virginia Coast for nearly a century. But the now small and inconspicuous building was dwarfed by

Lifesaving Museum of Virginia

The Norwegian families of both the rescued and the drowned presented a statue to the lifesavers of Seatack which stood at Atlantic Avenue and 25th Street in Virginia Beach. It was a gesture of thanks and a token of faith that all who go to sea might return home safely. The photo on page 37 is the the Life–Saving Museum of Virginia as it appeared in 1960. Courtesy of Life–Saving Museum of Virginia.

high rise hotels and the bustle of Virginia Beach tourism.

For awhile the building was maintained by hotel personnel who lived in it during the summer. But year by year it deteriorated until it became a refuge for derelicts frequenting the beach area. In 1980 a group of concerned citizens organized to save the historic building. Calling themselves the Life-saving Museum of Virginia Beach, they raised money and had the station house moved a short distance onto city property where it was refurbished and opened to the public in July 1981.

Today the Life-saving Museum of Virginia showcases the story of all of Virginia's surfmen. Displays of equipment, a diorama on the use of the breeches buoy, a video called "Those Who Stood Ready," and archival photos and papers trace the history of the lifesaving effort here and the many vessels that gratefully accepted its service. Curator Ann Dearman describes the museum as "a little gem on the oceanfront" and invites visitors to share in the experience of saving lives.

The museum is located at 24th Street and Atlantic Avenue in Virginia Beach and is open 7 days a week from Memorial Day to October 1. In the off-season it remains open Tuesday through Sunday.

Polarizing Photographs

Michael Halminski

Expanses of water and sky are superb subjects for picture taking. Anyone who spends much time out on the ocean has the opportunity to admire the glistening surface of the water or a sky laced with puffy, white clouds. Often, I've been intrigued by these sights, especially when using polarized sunglasses.

A polarizing filter on the lens of your camera can have a dramatic effect on your photographs. The filter appears transparent, and because of its crystalline properties, has the ability to block out light waves of a certain orientation, yet light waves oriented in another pass through. The filter transmits only light polarized in one plane.

By using a polarizing filter, a photographer can partially or completely eliminate unwanted reflections on water. The degree of elimination depends on the angle of reflected light. At angles of 30° glare reduction is maximum, while at angles of 90°, glare is unaffected. At intermediate angles reduction is partial. By rotating the filter, you can hold back all or part of the unwanted glare. Polarizers need not always be used in their maximum position. Sometimes glare reduction to a moderate degree produces a better photograph. It's really up to the individual's preference. If you use a single lens reflex camera, you can see both the desired and undesired effect in the viewfinder.

Most reflecting surfaces polarize light as they reflect it. Water, glass, polished or shiny objects are all good examples. Metallic surfaces do not have this characteristic, and as a result, highlights and reflections from these surfaces are not affected by polarizers.

Try increasing the contrast of sky and clouds by using a polarizer. An area of blue sky become deeper blue while clouds pick up more dramatic detail. Remember, when using the filter, more exposure is necessary since some amount of light is being blocked out. Most polarizers have a filter factor of 2.5. This means that you increase your exposure by about 1 ⅓ stops. With a through–the–lens light meter, your camera will self–compensate.

Have fun and do some experimenting. If you like the results, I'd be interested in seeing what develops. You can send photographs to the *Mariners Weather Log* or to me at Waves, NC 27982. Maybe we'll use your photos in a future issue.

The original photograph in color transparency (top right) was taken without a polarizer. Note the highlights on the water and the low contrast between the clouds and the sky. On the bottom right, a polarizing filter was used on the original color transparency. With the filter, a partial elimination of highlights on water and higher contrast in clouds and sky is possible.

Photographs from Ships at Sea

*The sunset (above) is what is commonly called a mackerel sky, most likely altocumulus. The term mackerel is derived from the resemblance to fish scales. This photograph was taken by Radio Operator C. Brown aboard the tanker SS **Guadalupe** of the Sabine Transportation Co. in January 1992. Below, is a waterspout in the Mediterranean Sea (near 38.5°N, 6.8°E) taken by Second Mate Thomas M. Murphy on the 11th of October 1992 at 1100 UTC from the bridge of the M/V **Samuel L. Cobb**.*

Weather Reports and VOS News

Martin S. Baron
National Weather Service,

Reporting Weather (Present and Past)
Group 7wwW1W2

The observations recorded and coded under the headings "present weather (ww)" and "past weather (W1W2)" include three different categories of phenomena. These are (1) hydrometeors (literally water in the air), (2) lithometeors (earth in the air), and (3) electrometeors (electricity in the air). A fourth category of phenomena, photometeors (optical phenomenon in the air), are not items of weather as the term is generally understood, and are not reported in code—their occurrence can be recorded in remarks for their general meteorological interest.

A meteor is commonly defined as any phenomenon or appearance in the atmosphere. The World Meteorological Organization definition is a bit broader, and includes deposits on the ground (and deposits on objects on the ground or in the air):

"A meteor is a phenomenon observed in the atmosphere or on the surface of the earth, which consists of a suspension, a precipitation, or a deposit of aqueous or non-aqueous liquid or solid particles, or a phenomenon of the nature of an optical or electrical manifestation."

A hydrometeor is a meteor consisting of liquid or solid water particles. These phenomena may occur as precipitation falling through the atmosphere, e.g. rain, drizzle, snow, snow pellets, snow grains, ice pellets, hail, or diamond dust (tiny ice crystals or needles which fall from a clear sky); as particles suspended in the atmosphere, e.g. clouds, fog, and mist; as particles raised by the wind from the surface of the earth or sea, e.g. drifting or blowing snow or sea spray; or as deposits on objects, e.g. freezing rain or freezing drizzle.

A lithometeor is a meteor consisting of particles most of which are solid and non-aqueous. The particles may be suspended in the air, e.g. haze (very small particles which give the air an opalescent appearance) or smoke, or may be lifted from the ground by the wind, e.g. drifting and blowing dust or sand, dust storm or sandstorm, dust or sand whirl (dust or sand in the form of a whirling column). An electrometeor is a visible or audible manifestation of atmospheric electricity. The most common electrometeors are lightning and thunder. The polar aurora and St. Elmo's fire (a luminous electrical discharge usually from elevated objects) are also electrometeors.

A photometeor is any luminous phenomena produced by the reflection, refraction, diffraction, or interference of light from the sun or moon. The commonest examples are the rainbow, halo, and corona. Again, these should be recorded when they occur; there is no provision for them to be included in code.

The ships' synoptic code contains 100 code figures for reporting present weather (00–99), and 10 code figures for past weather (0–9). Most of these are descriptions of the type, intensity, and variation of meteors either at your location or within sight. (Please see the Ships' Code Card, or National Weather Service (NWS) Observing Handbook No. 1 for an explanation of each.)

Five Reminders For Weather Observing, Coding, and Reporting

1. When using the state of the sea and Beaufort scale to estimate wind speed, remember that rain, surface and tidal currents will damp down the sea waves. Thus, under rainy conditions, or when in the vicinity of a current, your wind speed may actually be a little higher than that indicated from the sea state. When using a masthead anemometer, take a mean reading over a 10–minute period, and use a wind plotting board to determine true wind direction and speed (not needed when using the state of the sea method).
2. Don't confuse sea from swell. Confusion is most likely when the local wind direction happens to be with the incoming swell. The swell will always have a longer period than the sea and will be more regular and uniform.
3. Complete the transmission of your INMARSAT weather report in 30 seconds or less. This helps reduce communications costs paid by the NWS. Always end the INMARSAT message with 5 periods to disconnect.
4. Always include the first 5 code groups in your weather message. All code figures in this section must be filled in: BBXX D.....D YYGGiw 99LaLaLa QcLoLoLo
5. When reporting significant present or past weather (group 7wwW1W2), code the weather data indicator ix in group iRixhVV as 1; when there is no significant weather to report, 1x is coded as 2 and group 7wwW1W2 is omitted from the weather message.

Please review the past four Marine Observations Program columns in this publication or *NWS Observing Handbook No. 1* for detailed discussions on these points.

VOS/PMO Conference March, 1992

A conference and in-depth program review of the NWS Voluntary Observing Ship (VOS)/Port Meteorological Officer (PMO) program will be held in Jacksonville, Florida, the first week of March 1992. All PMOs, regional and national marine observations focal points, and representatives from the National Meteorological Center, National Hurricane Center, and National Climatic Data Center will attend. We also expect representatives from Great Britain and Canada. The conference will feature an assessment of present and future program activities, procedures, and methods. Principal concerns are data quality and transmission, the recruitment, service, and supply of vessels, and more complete data coverage from all marine areas. We are very anxious to receive input from ship masters and mates. Please present your concerns, ideas and suggestions about any aspects of the program to the PMOs, so these may be brought up and discussed at the conference

Marine Program Leader on Training Cruise

Marine Program Leader Vince Zegowitz spent most of January aboard the ***Patriot State***, the training ship of the Massachusetts Maritime Academy. He helped learn basic meteorology, especially weather observing and coding. He boarded the vessel in Buzzards Bay, Massachusetts, and travelled to Vera Cruz, Mexico, and returned to Washington via Barbados.

New PMO in Miami

We are pleased to announce that Charles "Chas" Henson is the new PMO for Miami, Florida. Chas is originally from Sylva, North Carolina. His Naval career spanned 24 years, and included duty stations in Guam, Jacksonville, Bermuda, New Orleans, Pearl Harbor, Pensacola, and Sigonella, Italy. As an Aerographer's Mate, he spent much of this time as a weather forecaster. For 7 years, as Ships' Liaison Officer, he trained quartermasters to take weather observations. For 3 years, as Ship Routing Senior Chief Petty Officer, he routed ships across the Pacific and Indian oceans. He retired from the Navy in 1990 and began working for the NWS in 1992 as Officer in Charge of the Wilkes-Barre/Scranton, PA. office. He has a B.A. degree from Chaminade University, Honolulu, and is completing work towards an M.P.A degree at the University of Florida. He enjoys fishing, boating, and most sports.

PMO selection Imminent for New York City

By the time this issue of the MWL goes to press, a new PMO will have been selected for New York City. Information about the new PMO will be available in the next Marine Observations Program column. During the 3-month period ending December 31, PMOs recruited 36 vessels as weather observers/reporters in the NWS VOS Program. Thank you for joining the VOS program.

Observations from moving ships form the basis of marine data acquisition programs worldwide. Forty–nine countries have VOS programs. Weather forecasting for marine and coastal areas depends very strongly on data from ships. Without ship participation, there would be vast marine areas without data. The dedication and commitment of ships officers is greatly appreciated.

NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM OCTOBER 1, 1992 TO DECEMBER 31, 1992

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
AFRICAN CAMELLIA	ELAG5	* ATLANTIC MARINE, LTD	HOUSTON, TX
BARBARA ANDRIE	WTC9407	BARBARA ANDRIE	CHICAGO, IL
CASSIA	C6DY5	EAST ASIATIC CO. LTD A/S	NEWARK, NJ
CATHAY SPIRIT	ELLO	TEEKAY SHIPPING LTD.	LOS ANGELES, CA
CEDRELA	C6JP9	TRANSMARINE NAVIGATION CORP.	SEATTLE, WA
CHESAPEAKE	KNFE	KEYSTONE SHIPPING CO.	SAN FRANCISCO, CA
CHEVRON ATLANTIC	C6KY3	CHEVRON SHIPPING CO	SAN FRANCISCO, CA
DOLE HONDURAS	ICWF	STANDARD FRUIT & STEAMSHIP CO.	BALTIMORE, MD
EMMA OLDENDORFF	ELDG7	WESTWOOD STEAMSHIP AGENCIES	SEATTLE, WA
ENERGY INDEPENDENCE	WBJF	CURTIS BAY COAL CO.	BALTIMORE, MD
FEDERAL SKEENA	LXBR	NAVIOS SHIPPING AGENCY	NEW ORLEANS, LA
HYUNDAI DUKE	3EVL9	HYUNDAI MERCHANT MARINE INC.	LOS ANGELES, CA
ISABELLA	3EAB6	BARBER SHIP MGMT., LTD	JACKSONVILLE, FL
JEB STUART	KSU9878	WATERMAN STEAMSHIP CO	SAN FRANCISCO, CA
JOHN PURVES	WTC9408	JOHN PURVES	CHICAGO, IL
KINSMAN ENTERPRISE	WAC4559	KINSMAN LINES, INC.	CLEVELAND, OH
LT ARGOSY	VTKG	* LARSEN & TOUBRO CO. LTD, SHIPPING DIVISION	HOUSTON, TX
MARINE PRINCESS	WNLH	MARINE TRANSPORT LINES INC. MEADOWLAND PLAZA	NEW ORLEANS, LA
MERLION ACE	9VHJ	WILLIAMS, DIMOND & COMPANY	LOS ANGELES, CA
MYSTIC	PGCJ	SEATRADE GRONINGEN B.V.	LOS ANGELES, CA
NEW CONDESA	3ETD3	EASTERN SHIPPING CO. LTD. (SHIN-HIBIYA BLDG.)	LOS ANGELES, CA
OMI WILLAMETTE	WGWA	OMI CORP.	SAN FRANCISCO, CA
RUBIN FOREST	3EUJ9	INTERNATIONAL SHIPPING CO.	SEATTLE, WA
SANGAY	ELOF7	COLUMBUS LINE	LOS ANGELES, CA
SANGHA	C6JN4		HOUSTON, TX
SEA SPRAY	WRXN	DONALD J. GAGNE	NEWARK, NJ
STAR ALABAMA	ELPG3	OVERSEAS FREIGHT CORP.	LOS ANGELES, CA
STRONG VIRGINIAN	KUS9879	BENGTSSON WALKER MARINE	SAN FRANCISCO, CA
SYNNOVE KNUSTEN	LAOO4	KNUSTEN O.A.S. SHIPPING	JACKSONVILLE, FL
TAI SHAN HAI	BONL	QINGDAO OCEAN SHIPPING CO.	LOS ANGELES, CA
TSL BOLD	V2KJ	REEDEREI B RICKMERS GMBH	NEWARK, NJ
USCGC LAUREL (WLB 291)	NRPJ	COMMANDING OFFICER	SAN FRANCISCO, CA
USCGC MADRONA	NRPT	COMMANDING OFFICER-QM SECTION	NORFOLK, VA
USCGC RESOLUTE WMEC 620	NRLT	COMMANDING OFFICER	SAN FRANCISCO, CA
USCGC WHITEPINE	NODE	USCGC WHITEPINE (WLM 547)	NEW ORLEANS, LA
USNS GUADALUPE	NLUP	USNS GUADALUPE T-AO 200	NEW ORLEANS, LA

Interview, Awards, and News

Getting to Know Your PMO

Martin Bonk, PMO Newark

How long have you been in the National Weather Service?

It's been a total of 3 years. I came to NWS in April 1990. I was a meteorological technician for 2 years at the National Weather Service at Newark. I've been a PMO for another year.

What was your background before your PMO days?

I spent 31 years in the Navy. I worked as a aerographers' mate and a Master Chief Petty Officer. I served on the ***U.S.S. Belleau Wood,*** the ***U.S.S Springfield,*** the ***Tripoli,*** that's the one off Somalia right now. I was aboard eight ships altogether. I attended Aerographer's Mate Class "A" school for observers and then Class "B" class for forecasters. From 1957 to 1988, I served the Navy and Naval Reserve. I retired in 1988 and went to the Naval Oceanographic Command in 1988.

Any hairy weather experience aboard the Navy ships?

No, I didn't have any hairy experiences, but I did have many ship deployments to Viet Nam with many boring hours and a few terrifying minutes.

As PMO in Newark, do you find it a fairly busy port?

I'm kept pretty busy. The cargo in Port Newark and Elizabeth, New Jersey is primarily container vessels and car carrier traffic. I made probably around 900 ship visits in a year's time.

Describe a typical ship visit.

I first check their barometer for accuracy. I hand out the observing forms. I'm always trying to recruit new ships to the VOS program. I tempt them with the *Mariners Weather Log.*

Does it work?

Martin: Just yesterday I went on the ***Raphael B*** and left

three copies of the Log. Sometimes there's not a soul around and I leave the Log with my business card.

Did the Raphael B sign on?

No.

Seriously, how do you really recruit ships?

The first question I ask is, 'Do you take weather observations?' Recently, I asked the Captain on the ***Forest Hawk,*** and he said he didn't have the forms. So I gave him a VOS box and signed him on. The box is filled with observation forms, sea and swell charts, cloud charts, observing books, the pink sheets— they write the observations on them—if they need a thermometer or a barometer or a barograph, I give them one. I gave him a small VOS plague.

Once the ship is entered in the computer, they get the free stuff from the government, the *Mariners Weather Log,* other NOAA publications, the neat free stuff.

What do you consider is a PMO's most important function?

First visiting ships is crucial in getting ships to sign up for the VOS. I educate and train personnel on the importance of taking observations. I tell them how important it is, how it helps in analysis and forecasts. I tell them we need them.

I also lecture on the VOS Program. I visited the Massachusetts Maritime Academy, and SUNY at New York.

Can you tell us a little about your family?

I've been married 32 years to my wife Linda.

In interviewing PMOs I've noticed that most of them have been married for decades. Why do you think that is?

I say I got lucky. No, I'm from the Before Divorce generation. Once you've gone through the rough times, the rest is gravy. I tell my wife we stayed married because I was gone so long in the Navy.

What about the rest of your family?

I have two daughters, Connie and Virginia.

What are your hobbies when you're not visiting ships?

Gardening, travelling, reading, playing with my two handsome grandsons, Joshua and Thomas.

In the last issue we ran this awards photograph and accidently misidentified the ship (above). This is the crew of the NOAA ship ***Whiting.*** *The recipients (left to right) are CQM Ed Jaynes, Captain Andrew Armstrong III, Ordinary Seaman Tracy Rush and Ordinary (not really) Seaman Cheryl Ude. Dave Bakeman, PMO Seattle, was happy to present a 1991 observing award to the Great Land (above, right). From left to right are Captain Michael J. Kucharski, Chief Mate George P. Emmons, 3rd Mate Barry Smith, 2nd Mate Louis J. Hartmann and, of course, Dave Bakeman.*

A Top Ten Award

*The crew of the **SEDCO BP-471** (aka R/V **Joides Resolution**) proudly displays its 1991 Top Ten Award from the NOAA/NOS SEAS Program. Pictured from left to right are Captain Ed Oonk, Ocean Drilling Program Technician "Gus" Gustafson, Third Mate Mike Horton, Chief Mate Tom Hanrahan and 2nd Mate Clarie Watt. The award was presented in absentia by Steve Cook. With advancing years, he has become a little camera shy.*

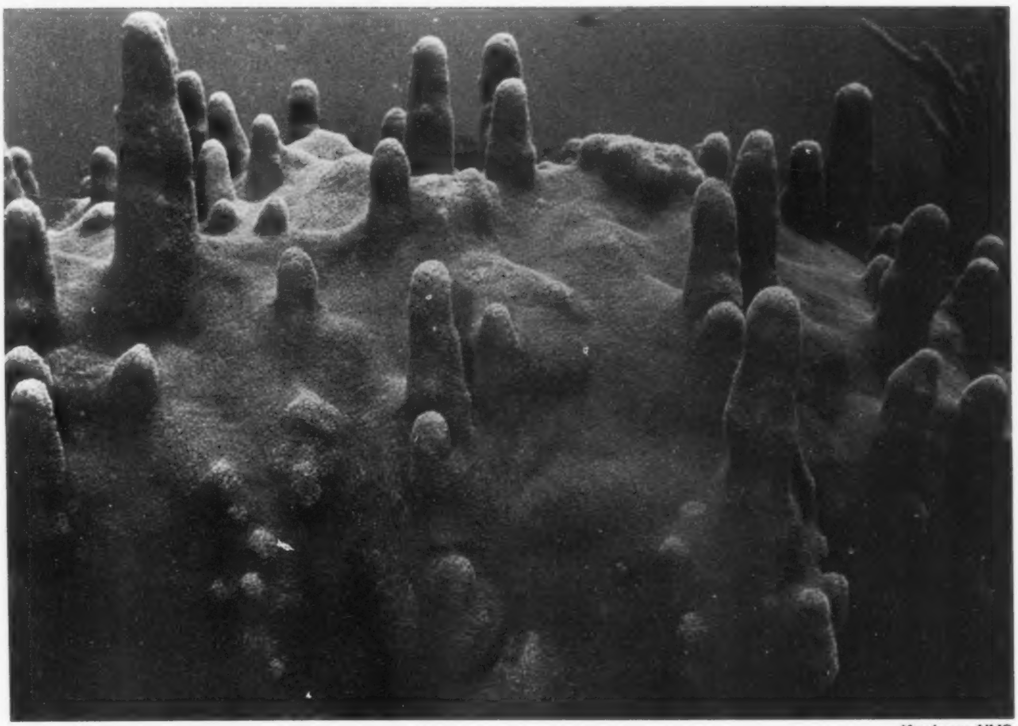
1- 800 BE-ALERT

REPORT DRUG SMUGGLING

The National Marine Sanctuaries

Key Largo National Marine Sanctuary

Justin Kenney



Key Largo NMS

National Marine Sanctuary Program
National Oceanographic Data Center

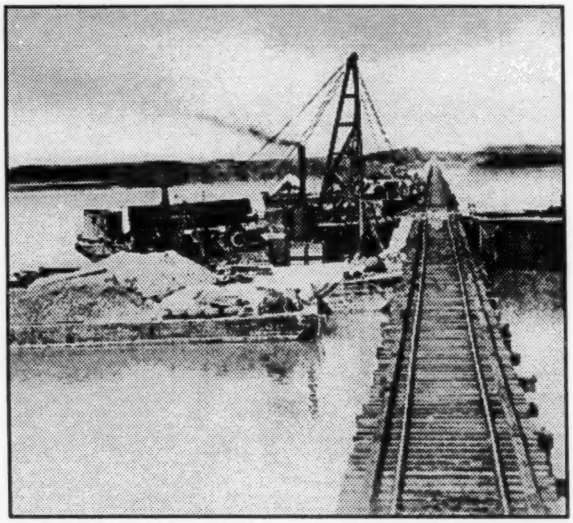
Ponce De Leon, one of the first Europeans to land on the dazzling white beaches of the Florida, was said to have been looking for the legendary Fountain of Youth. That impossible dream has been displaced by realistic treasures in the beautiful underwater world of the Florida Keys. A long trail of adventurers and explorers all felt the irresistible pull of the Florida Keys. Swashbucklers, missionaries, oceanographers, and adventurers have made the area rich in history and culture.

Ringing the small islands, the clear waters of Key Largo contain a world rich in natural treasures. The world's largest coral bed was long taken for granted by the countless divers. Only through a series of disasters in the Fall of 1989 did a call for serious change in the management of the Keys' marine resources lead to the creation of the Key Largo National Marine Sanctuary.

The Key Largo National Marine Sanctuary extends some 3 miles seaward, and protects the underwater world of living coral reefs.

Located at the southern tip of Florida, the Keys span a 120-mile long chain of ancient coral rock islands. The most prolific coral reef development, and much of the historical and cultural past of the Keys can be found in the waters of Key Largo. In 1975 this 100–square nautical mile tract, extending some 3 miles seaward of the northern Keys, was designated a national marine sanctuary following local and national concern over the unchecked exploitation of the coral reef ecosystem and its inhabitants. Over the past 18 years, the public's relationship with the coral reefs has continued to change, and today the reefs and their inhabitants are viewed with respect and concern. Not long ago, a vessel run aground on the reefs translated into economic opportunities. Today it translates into economic disaster.

For 15th century Spanish explorers, the Keys meant danger, and were to be feared. For sailing ships laden with Mexican gold and silver, the long voyage back to Europe began with a dangerous passage through the Straits of Florida. Hidden coral outcroppings often only inches below the surface, poor navigational tools (NOAA charts not yet available), and violent hurricanes made the voyage past the Keys a difficult mission, one often ending in disaster. Once safely past the northernmost Keys, these vessels could proceed with relative ease up the coastline until they could hitch a ride across the Atlantic on the Gulf Stream. For those less fortunate, lives and cargo were lost among the reefs of the Florida Keys.



The lunar–like scene on page 1a are actually rare pillar coral poking up from the sea floor in the sanctuary. These small plants, too often broken by boat groundings grow relatively undisturbed in the sanctuary. Above, the Florida East Coast Railway is seen making inroads into the Keys in the early 1900s. The scene here is at Wilson's Key Channel. Photo courtesy of Seth Bramson.

The harrowing experiences of these early explorers portended a rough and rugged history. The harsh environment, with little fresh water and farm land, and ever present mosquitoes made settling on the Keys difficult. Early residents encountered Seminole tribes angered by their forced displacement to the Keys by the U.S. military actions of the early 1800s. By the time Florida was admitted into the Union in 1821, the Native American population was all but extinguished, with only the most defiant remaining.

The Keys' complex network of channels and islands surrounded by thick mangrove forests provided the perfect haven for escaped slaves and truants of the law. As these early residents settled, commercial fish-

Mariners Weather Log

Key Largo is the second in a series of articles on U.S. marine sanctuaries. Each sanctuary has a story to be told and Key Largo's emphasizes the importance of protecting the life that flourishes underneath the sea.
Special thanks to Paige Gill and Bruce Terrell for their assistance with this article. For additional information on Key Largo National Marine Sanctuary, please write to P.O. Box 1083, Key Largo, Florida 33037.

ing and sponging industries slowly began to take root in places like Key West. Wreckers and salvors from the Bahamas and New England established Indian Key as their center of activities to rescue victims, and more important their cargo, off of the dangerous reefs. So treacherous were the waters, that 50 wrecking vessels were in operation between 1831 and 1844. Piracy was in its heyday during this time, with an estimated 10,000 pirates working the waters between Florida and Cuba in the 1800s.

At the turn of the century, recognizing the economic value in having the closest shipping center to the Panama Canal, the Florida East Coast Railway began a mammoth undertaking to extend the railroad from Homestead out to Key West, forever changing life in the Keys. The railroad also brought a new business to the Keys—tourism. Travelers lured by luxury accommodations, crystal clear waters, and world-class fishing, began arriving by train from Miami aboard the "Havana Special," and later by car along the famous Overseas Highway. American legends who came to enjoy the Keys, such as Franklin Roosevelt, Zane Grey, Ernest Hemingway, and Tennessee Williams, added to its lore.

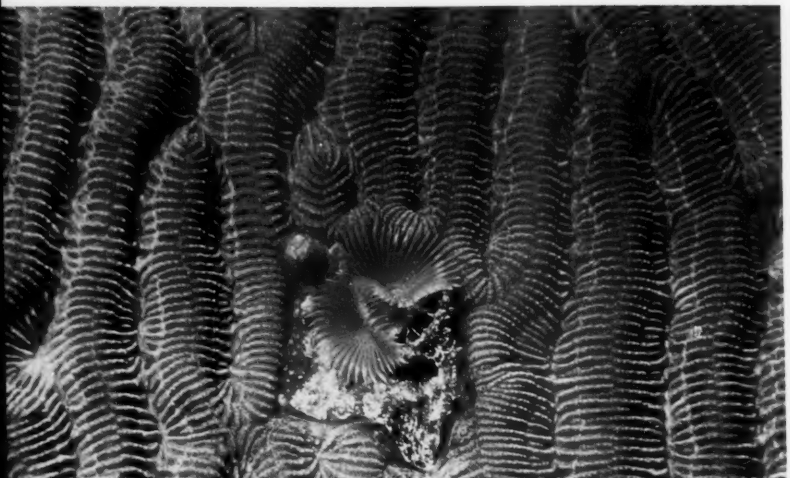
Probably the invention of the aqualung in 1943, and the subsequent explosion in the popularity of scuba diving, provided the Keys' economy with its biggest boost. Today, more than 60 dive shops can be found in the Keys, and over a million tourists from around the world arrive each year to fish and dive.

One of the more popular destinations continues to be the coral reefs of Key Largo. The warm, clean waters brought by the nearby Gulf Stream provide a marine environment ideally suited for the reef building corals. These tiny animals form the reefs by secreting a skeletal deposit, and slowly colonize into the beautiful underwater gardens that have made Key Largo worthy of protection.

For the novice snorkeler and expert scuba diver alike, Key Largo offers a chance to witness marine life and swim with the tropical fish that inhabit this coral city. Schools of brightly colored grunts dash about large brain corals like a small city hustling to and from work. Great barracudas patrol among the elkhorn corals looking for prey. Spiny lobsters and spotted morays stalk the back alleys and crevices of giant pillar coral and thick turtle grass, awaiting a stray meal.

In addition to the reefs, the sunken remains of ships—ill-fated 15th century Spanish galleons, British war ships, and World War II freighters—offer an unforgettable experience for divers. Often found in only

Life Beneath



Most of these photographs were submitted as entries in Florida Keys photograph contest.

The clever Trumpet Fish aka "Ambush Predator" (above, left) can hover motionless above the corals while awaiting small crustaceans and fish. It will change colors to match its surroundings and in this photo mimics sea whip branches. In the black and white photograph at left, it's hard to tell the feather duster worm from the brain coral. Feather duster worms develop calcified tubes within coral colonies and feed by extending an elaborate tentacled crown that filters passing plankton.

Like a bejeweled socialite at the Fontainebleau, the delicate Basket Star (above) awaits an evening meal. A relative of starfish, sea urchins, and crinoids or sea lilies, it spends the day-

George Munce

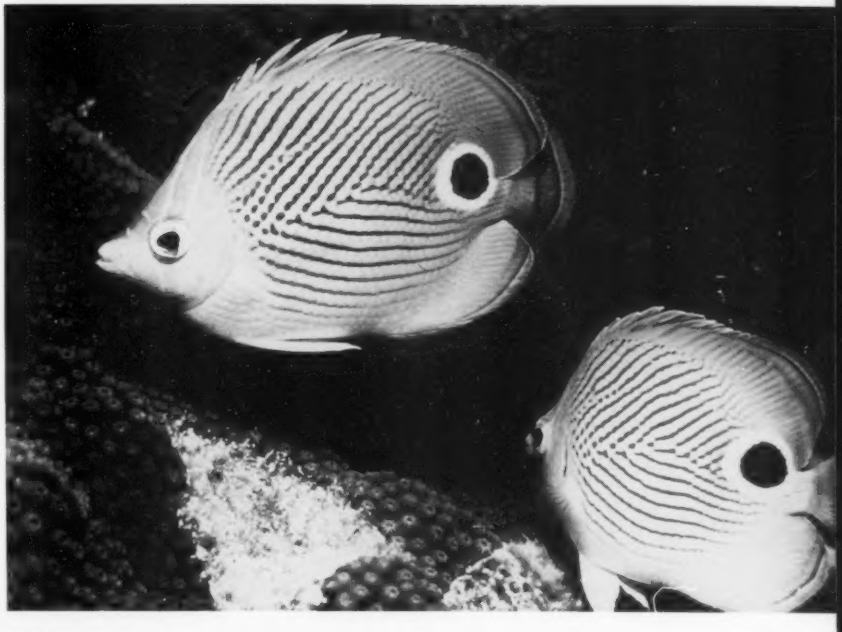
the Reef

Scott Pearson

time hours with its long rays rolled up. Only at night does the Basket Star extend its rays to dine on passing plankton.

The grey angelfish (top right) takes a spectacular portrait even in black and white. Its distinctive mouth is painted a brilliant white as is the edge of its tail. Angelfish are among the most colorful species with its colors often undergoing dramatic changes as they progress from juvenile to adult.

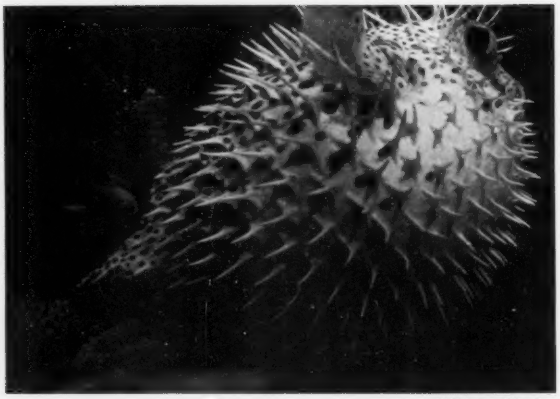
A dark black spot on the tail of the four-eyed butterfly fish (right) is responsible for its common name. They are among the few coral-eating fishes found in the Keys and their population can be monitored to give an indication of the health of the coral. Related to angelfish, they are colorful and among the most popular of aquarium fishes.



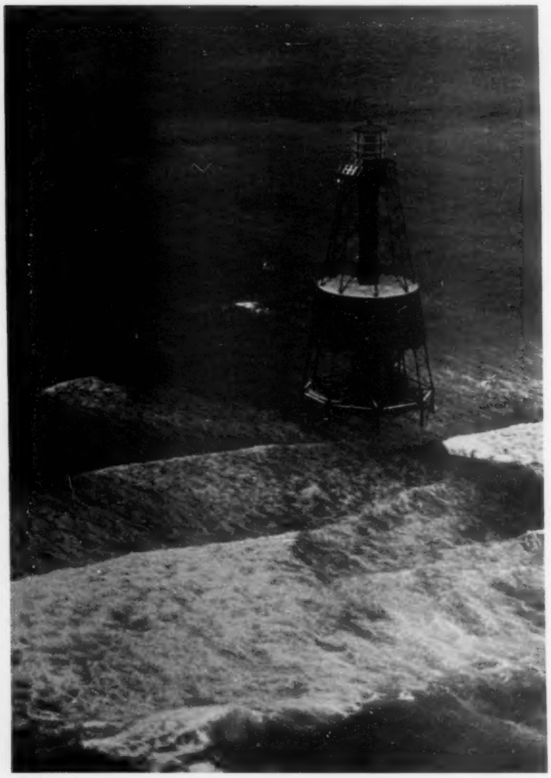
Chris Huss

several feet of water, one need only to slip below the surface to enter the silent world of the past. One of the more popular wrecks is the 360-foot freighter ***Benwood.*** Its fate was long debated among residents of the Keys. Originally heralded as the courageous victim of enemy fire from a German U-boat, recent study reveals that it sank as a result of human error in avoiding a deadly collision.

The Key Largo sanctuary is also home to the oldest operating lighthouse of its kind in the United States. Once considered haunted, it is featured in a forthcoming book by lighthouse authority Elinor De Wire (see Mariner Weather Log, Fall '92 issue). Lighted in March 1852, Carysfort Lighthouse continues to steer vessels clear of Carysfort Reef (named after the 20-gun frigate HMS ***Carysford*** that ran aground in 1770). The wrought-iron lighthouse was literally screwed into the coral and down into the ocean floor. It included living quarters for the lighthouse keeper. Since a working lighthouse spelled trouble for the then thriving wrecking business in the Keys, law prohibited the lighthouse keeper from working in the wrecking and salvage business so as to discourage any "accidental" mechanical mishaps. Today's efforts to preserve the now unmanned lighthouse include a plan to convert it into a working research station.



Katheryn Napier



Mike White

The Carysfort Lighthouse (above) was screwed into the coral after the government twice tried to anchor a lightship on the reef. It was first lit in 1852.

Sensing an intruder nearby, the porcupine fish (above, right) puffs up and exposes sharp spines. Its rigid body skeleton allows it to protect itself from predators. If that doesn't work, its toxic tissue is a second line of defense. Reaching a length of 10 inches, the porcupine fish is a less than popular inhabitant of the sanctuary.

The collection of natural and cultural resources located in the Key Largo sanctuary makes it an obvious destination for fishers, divers, and boaters. But the imposing size and strength of the reefs betray the delicate corals that cover them. The slightest bump from a well-meaning diver or a carelessly dropped anchor can injure a coral and expose the colony to deadly infection and disease. This and other relatively minor damage to the coral reefs, when multiplied by the thousands of boaters and divers that come to the Keys, can lead to considerable harm.

Research and education efforts under way at Key Largo to protect the reefs involve the combined efforts of local citizens, industry, dive shops, fishermen, and scientists. One such effort addressed the extent of damage caused by boat anchors, chains, and ropes. Key Largo Biologist John Halas devised and installed a system of mooring buoys to provide the thousands of boats that come to Key Largo each year with an alternative to anchoring. Through education and enforcement, anchor damage to reefs has been reduced, and the successful mooring system has been duplicated in marine protected areas around the world.

Yet despite the conservation efforts at Key Largo, the coral reef and seagrass habitats continue to show signs of fatigue and misuse, and many residents express concern that existing protection efforts are not enough.

Key Largo NMS

"The Wellwood grounding (above) turned a portion of this flourishing coral reef into what looked like a parking lot. Massive and branching coral heads were toppled, abraded, or simply crushed by the 6,000 ton ship. Many gorgonian corals (sea fans, sea whips, and sea feathers) were reduced to skeletons by the harsh grinding of the ship over the reef."

The threats to Key Largo extend well beyond its boundaries. Many fear that improperly treated waste, runoff from urban and agricultural communities, and the substantial diversion of natural water flow through the Everglades and into Florida Bay are upsetting the delicate balance so vital to the health of the coral reef ecosystem. At the same time, increased development and the subsequent loss of mangrove forests along the coastline magnifies the problem by reducing the natural filtering process the mangroves provide in supplying the coral reef with essential clean and clear water and nursery ground for its marine species.

In the early morning of August 4, 1984 , the Cypriot–registered 400–foot M/V ***Wellwood*** was traveling northeastward 5.5 nautical miles offshore from Key Largo, FL. With a massive boom, the vessel hit Molasses Reef in about 8 meters of water. It flattened everything in its path and came to a stop in 6 meters of water. It would be lodged there for 12 days until tugs removed much of its fuel, and cargo (animal feed grain pellets) were offloaded to other vessels. The destruction didn't end after the Wellwood came to a grinding halt. Resting as it did for almost 2 weeks on the reef kept the corals, not destroyed outright, in dark shade. Symbiotic algae necessary to the coral growth were expelled by the lack of sunlight. The coral was damaged again by the tug cables used to pull the ship off the reef.

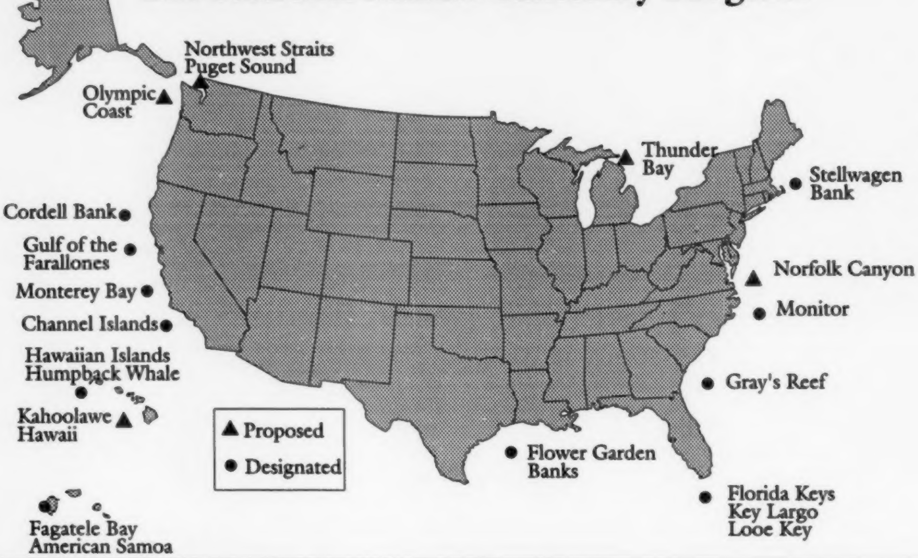
Five years after the ***Wellwood*** disaster, the birth of the Florida Keys National Marine Sanctuary grew out of further ecological destruction. Within 16 days in 1989, three large freighters ran aground, pulverizing over 16,000 square meters of coral reef. Within a year, the Florida Keys National Marine Sanctuary was designated to include the waters surrounding the Keys and Dry Tortugas, from the high water mark out to the waters of Florida Bay, the Gulf of Mexico, and the Atlantic Ocean—in all, over 2,800 square nautical miles. The difficult task of balancing the people and culture of the Keys with the natural resources remains the challenge of groups like the Florida Keys Advisory Council, a volunteer group comprised of citizens, researchers, fishermen, dive shop operators, environmentalists, and others.

Early explorers of the Keys risked their lives in search of the improbable and possible. Today, it is the residents of the Keys, both on land and in the water, that are at risk. The obvious desire to experience the beauty of the Keys has not come without a price. The next chapter in the continuing story of the Keys will be the protection of the health of the reefs and the quality of life they support. The work begun in Key Largo serves as the foundation for protecting the entire Keys—our success will be determined by future generations lured by the beauty, history, and culture of the Keys.

Key Largo NMS

The sun spotlights the underwater figure "Christ of the Deep." The 9–foot tall, 4,000 pound bronze statue was placed underwater before the area became a sanctuary. A replica of the Italian "Christ of the Abysses," its purpose was to inspire those who live, work or play by the sea and to give comfort to those who have lost loved ones to the sea.

The National Marine Sanctuary Program



Our nation's marine waters support an incredible diversity of life—the lush kelp forests off the coast of California, the limestone outcroppings of Georgia's Gray's Reef, the tropical coral reef within an ancient submerged volcano of American Samoa, and the colorful coral reefs of the Florida Keys. The mystery and beauty of these delicate ecosystems inspire scientist and poet alike to understand and appreciate their marine treasures. These waters also hold the secrets of our nation's past. Sunken civilizations, naval and commercial vessels, and countless artifacts lie silently waiting for their stories to be told.

In recognition of the special ecological, historical, recreational, and aesthetic values of our marine waters, the National Marine Sanctuary Program was established in 1972 to provide long-term protection and management. Under the direction of the National Oceanic and Atmospheric Administration, 13 marine sanctuaries have been designated, each unique in the natural and cultural resources it contains. Part of the collective riches of our nation, the sanctuaries belong to all of us to enjoy, to learn from, and most important to protect for future generations.

Channel Islands NMS
113 Harbor Way
Santa Barbara, CA 93109
(805) 966-7107

Cordell Bank NMS
Fort Mason
Building #201
San Francisco, CA 94123
(415) 556-3509

Fagatele Bay NMS
P.O. Box 4318
Pago Pago, AS 96799
(684) 633-5155

Florida Keys NMS
P.O. Box 1083
Key Largo, FL 33037
(305) 451-1644

Flower Garden Banks NMS
1716 Briarcrest Drive
Suite 702
Bryant, TX 77802
(409) 847-9296

Gray's Reef NMS
P.O. Box 13687
Savannah, GA 31416
(912) 356-2496

Gulf of the Farallones NMS
Fort Mason
Building #201
San Francisco, CA 94123
(415) 556-3509

Key Largo NMS
P.O. Box 1083
Key Largo, FL 33037
(305) 451-1644

Looe Key NMS
Route 1, Box 782
Big Pine Key, FL 33043
(305) 872-4039

Monitor NMS
NOAA
Building 1519
Fort Eustis, VA 23604
(804) 878-3511

Monterey Bay NMS
Hawaiian Islands
Humpback Whale
Stellwagen Bank
1825 Connecticut Ave. NW
Suite 714
Washington, D.C. 20235
(202) 606-4126

Iceberg Warnings

Lt. Alfred T. Ezman
U. S. Coast Guard

Ignoring urgent iceberg warnings, the massive passenger ship's crew continued to increase its speed to 22 knots. The night was crisp and surface fog impeded the crewmen's vision. Then shortly before midnight, off the Grand Banks of Newfoundland, the mighty vessel RMS ***Titanic*** struck a portion of an iceberg that lay beneath the water's surface. A little more than 2 ½ hours later, the Atlantic Ocean swallowed the ship. Eventually, more than 1,500 lives—passengers and crew—were lost, making it one of the most tragic disasters in maritime history.

It was this disaster that led to the creation of the International Ice Patrol (IIP). Recognizing the dangers that icebergs present to vessels, the IIP was assigned the mission of warning mariners of iceberg threats and positions in a region covering the southwest, south, and southeast of the Grand Banks off Newfoundland, Canada, the same location where the Titanic went down.

Several contributing factors make the northwest Atlantic a particularly dangerous region for navigation. The great circle routes between Europe and the major ports of the United States and Canada passing through the Grand Banks makes this a heavily travelled region. At the same time, some of the thousands of icebergs calved from Greenland glaciers are transported by ocean currents to the Grand Banks. The region is also very dynamic oceanographically. This is where the Labrador Current meets the warm Gulf Stream resulting in dense fog much of the year. The prevalence of fog, drifting icebergs, severe storm conditions, concentration of transAtlantic shipping and the presence of numerous fishing vessels make this region one of the most hazardous for marine traffic.

To ensure safe passage for mariners, IIP depends on cooperation and assistance from international shipping in the North Atlantic. In 1992, 22% of all iceberg sightings reports came from ship reports.

The M/V ***Cast Polar Bear*** was the top reporter for 1992 having submitted 48 ice reports. This assistance enables the Ice Patrol to provide specific iceberg warnings to mariners. The IIP is grateful to those ships who made contributions during the 1992 season and asks for continuing support in 1993. All ships transiting the region are encouraged to report ice conditions every 6 hours to the IIP Operations Center in Groton, Connecticut. The following information should be included in the ship's ice report:

◊ Ship's name and call sign
◊ Ship's position, course, and speed
◊ Position of the ice and time of sighting
◊ Indication whether sighting was visual or radar
◊ Approximate size and shape of iceberg
◊ Concentration of ice (sea ice in tenths)
◊ Sea surface temperature.

Negative ice reports are also very valuable.

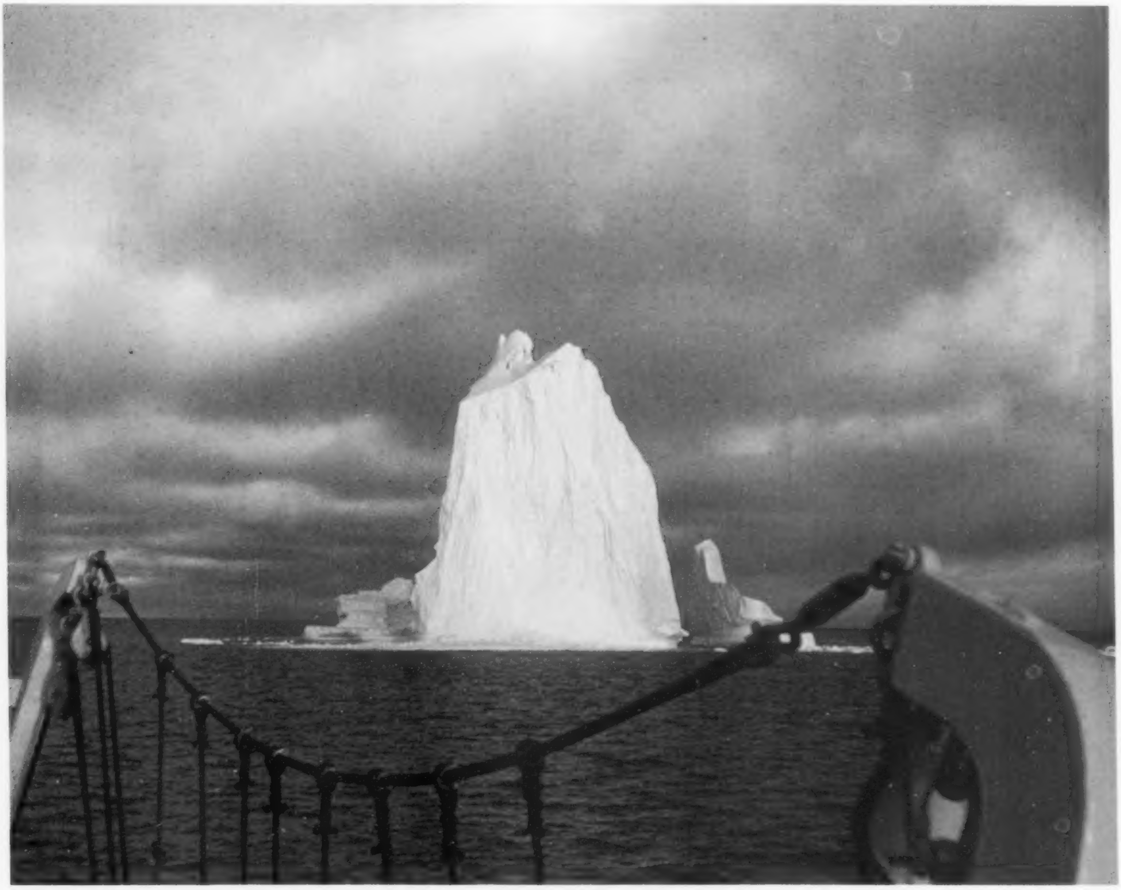
Ice sightings reports should be sent to any U.S. Coast Guard Communication Station or Canadian Coast Guard Marine Radio Station. The reports are handled free of charge through these stations. The ice season normally begins in March and ends in July. The IIP also uses aircraft to search for and identify icebergs and flies five daily patrols out of St. John's, Newfoundland every other week during the ice season.

Iceberg information gathered from all sources is then entered into the IIP drift model. This computer model drifts and melts the icebergs according to the

ocean current and sea surface temperature data input. Limits of all known ice are constructed around the model predicted drift of the outermost icebergs and are broadcast as an Ice Bulletin from the United States and Canadian Radio Stations to warn mariners.

Since the inception of the International Ice Patrol, there has not been a single reported loss of life or property due to collision with an iceberg outside the advertised limits of all known ice in this area. However, the dangerous environmental conditions in the region clearly warrant the IIP's continued marine warnings.

During the 1993 ice season, the IIP will have the latest 12Z Ice Bulletin, with Limits of All Known Ice, in the IIP fax machine available for polling by calling (203) 441-2773, 12Z to 20Z daily. Anticipate daily update prior to 1500Z.



U. S. Coast Guard

1993 International Ice Patrol Service

In February or March of 1993, depending upon iceberg conditions, the International Ice Patrol will commence its annual service of guarding the southeastern, southern, and southwestern limits of icebergs in the vicinity of the Grand Banks of Newfoundland. Reports of ice in this area will originate from passing ships and aircraft and from flights by International Ice Patrol (IIP) aircraft. During the ice season, IIP will broadcast two message bulletins each day and a daily radiofacsimile chart containing ice information to inform ships of the extent of the estimated limits of all known ice. Broadcasts from IIP will be as indicated on page 58.

INTERNATIONAL ICE PATROL BROADCASTS

BROADCAST STATION	TIME OF BROADCAST (UTC)	FREQUENCIES (kHz)
NAVTEX BROADCASTS		
Coast Guard Communication Station Boston/NIK	0445, 0845 1245, 1645 2045, 0045	518
Canadian CG Radio Station Sydney/ZCO	2240	518
NBDP (FEC) BROADCASTS		
Coast Guard Communication Station Boston/NIK	0030 1218	6314, 8416.5, 12579 8416.5, 12579, 16806.5
CW BROADCASTS		
Coast Guard Communication Station Boston/NIK (Bcst to follow NBDP bcst)	0050 1250	5320, 8502, 12750 8502, 12750
Canadian CG Radio Station St. John's/VON	0000 1400	478
Canadian Forces METOC Centre Halifax/CFH	0015, 1101 1301, 1401 2201, 2301	122.5 Cont. (off air 1200-1600 2nd Thurs. each month) 4271 (2200–1000 UTC) 6496.4 Cont. 10536, Cont.,13510 (1000-2200 UTC)
Canadian Coast Guard Radio Station Halifax/VCS	1330 2200	4285, 6491.5, 8440 12874, 16948, 22619.5 (Broadcast on frequencies as advertised by CN marker tape.
LCMP BROADCASTS		
Norfolk, VA NMN/NAM/NAR	0800–0900 1500–1600 1600–1700 2100–2200	8090, 12135, 16180 8090, 12135, 16180, 20225 8090, 12135, 16180, 20225 8090, 12135, 6180, 20225
Key West, FL/NAR	0800–0900 1500–1600 1600–1700 2100–2200	5870 5870, 26725 5870, 26725 5870, 26725
RADIOFACSIMILE BROADCASTS		
Coast Guard Communication Station Boston/NIK	1600	8502, 12750(+/- 400 Hz)

BROADCAST STATION	TIME OF BROADCAST (Z)	FREQUENCIES (kHz)
Radio Station Bracknell, Great Britain/GFE (Eastern North Atlantic Sea Ice Observations)	1602	2618.5 (1800-0600, Oct. 1–Mar 31; 1900-0500, Apr 1-Sep 30); 4782 Cont.; 9203

(0600-1800 Oct 1 – Mar. 31;	Cont.; 14436 30)	Cont;18261 0500-1900 Apr. 1 - Sept.
Canadian Forces METOC Cen. Halifax/CFH (Primarily sea ice in Gulf of St. Lawrence and North. Limits of icebergs sometimes given.	0015, 1101 1301, 1401 2201, 2301	122.5 Cont., (off air 1200-1600 second Thurs. each month); 4271 (2200-1000 UTC); 6496.4 Cont.; 10536 Cont.; 13510 (1000–2000 UTC)

COMSAT BROADCASTS

The 00Z and 12Z Ice Bulletins will be broadcast over the AOR-W Satellite at 00z and 12Z daily. Safety broadcasts made by the International Ice Patrol regarding icebergs outside of the limits of All Known Ice will only be made over the AOR–W–Satellite.

RADIO TELEX

Canadian Coast Guard Marine Radio Station Halifax/VCS	0630 1630 2300	4213.5 8419.5 4213.5

RADIO TELEPHONE

Canadian Coast Guard Marine Radio Station Halifax/VCS	1335 2335	4408, 8785, 13113

SPECIAL BROADCASTS

Canadian CG Radio Station St. John's/VON	As required when icebergs are sighted outside the limits of ice between regularly scheduled broadcasts.	2598 Radiotelephone preceded by Inter-Safety Signal (SECURITE) on 2182 kHz. 478 (CW) Preceded by International Safety Signal (TTT) on 500 kHz.
Coast Guard Communication Station Boston/NIK	As required when ice–bergs are sighted outside the limits of ice between regularly scheduled broadcasts. NAVTEX upon receipt or first available BCST window. NBDP (FEC) next scheduled BCST.	472 (CW) preceded by International Safety Signal (TTT) on 500 kHz.
International Ice Patrol Vessel/NIDK (when assigned)	When in the vicinity of ice in periods of darkness or fog.	2670 Preceded by International Safety Signal (SECURITE) on 2182 kHz.

HONOLULU, HAWAII, U.S.A.

CALL SIGN	FREQUENCIES	TIMES	EMISSION	POWER
KVM70	9982.5 kHz	CONTINUOUS	F3C	10 KW
	11090 kHz	CONTINUOUS	F3C	10 KW
	16135 kHz	CONTINUOUS	F3C	10 KW
	23331.5 kHz	CONTINUOUS	F3C	10 KW

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0001/1201	SATELLITE IMAGERY (IR)	120/576	00/12	DISK
0017/1217	PACIFIC SURFACE ANAL	120/576	18/06	B
0041/1241	TROPICAL SURFACE ANAL	120/576	18/06	C
0106/1306	24HR SURFACE/THICKNESS PROGS	120/576	12/00	D
0128/1328	48HR SURFACE/THICKNESS PROGS	120/576	12/00	D
0150/------	24HR WIND/STREAM PROG	120/576	12/---	E
0216/------	48HR WIND/STREAM PROG	120/576	12/---	E
-------/1352	24HR OCEAN WINDS/SIG WAVE HT PROG	120/576	---/00	F
-------/1408	48HR OCEAN WINDS/SIG WAVE HT PROG	120/576	---/00	F
-------/1424	72HR OCEAN WINDS/SIG WAVE HT PROG	120/576	---/00	F
0533/1733	TEST CHART/ID/SCHEDULE	120/576		
0547/1747	SIGNIFICANT CLOUD FEATURES	120/576	00/12	A
0601/1801	SATELLITE IMAGERY (IR)	120/576	06/18	DISK
0617/1817	PACIFIC SURFACE ANAL	120/576	00/12	B
0641/1841	TROPICAL SURFACE ANAL	120/576	00/12	C
0706/1906	72HR SURFACE PROG	120/576	12/00	D
0730/------	SEA SURFACE TEMP	120/576		HA
-------/1928	OCEAN SURFACE TEMPS	120/576		PA
1133/2333	TEST CHART/ID/SCHEDULE	120/576		
1147/2347	SIGNIFICANT CLOUD FEATURES	120/576	06/18	A

MAP AREAS:

A - 40N 160E, 40N 110W, 25S 160E, 25S 110W
B - 55N 130E, 55N 110W, 25S 130E, 25S 110W
C - 30N 120E, 30N 110W, 50S 120E, 50S 110W
D - 60N 110E, 60N 055W, 55S 110E, 55S 055W
E - 50N 120E, 50N 105W, 30S 120E, 30S 105W
F - 60N 130E, 60N 115W, 35S 130E, 35S 115W
HA - HAWAII AREA
PA - PACIFIC AREA
DISK - GEOSTATIONARY SATELLITE

ALL CHARTS ARE MERCATOR PROJECTION EXCEPT DISK AND HA.

NOTES:

(1) TROPICAL SURFACE ANAL & WIND/STREAM PROG CHARTS DISPLAY 1000MB STREAM FUNCTION LINES. WIND SPEEDS IN KNOTS FOR ALL LATITUDES MAY BE APPROXIMATED BY DIVIDING 50 BY THE SPACING BETWEEN THE STREAM FUNCTION LINES EXPRESSED IN DEGREES OF LATITUDE. THESE CHARTS, COMPUTER GENERATED AT THE NATIONAL METEOROLOGICAL CENTER (NMC), WASHINGTON, DC, ARE PARTICULARLY USEFUL IN THE TROPICS, WHERE ISOBARIC SPACING AND WIND SPEED RELATIONSHIP BECOMES LESS MEANINGFUL. CENTERS ARE LABELED "A" FOR ANTICYCLONIC CIRCULATION AND "C" FOR CYCLONIC CIRCULATION AND MAY BE EQUATED TO HIGH AND LOW PRESSURE CENTERS, RESPECTIVELY. CAUTION IS ADVISED WHEN USING THESE CHARTS. BEING STRICTLY COMPUTER GENERATED, THEY MAY NOT DELINEATE SMALL, THOUGH INTENSE, SYSTEMS IN DATA-SPARSE AREAS. TO COMPENSATE, NOTES ARE MANUALLY ADDED TO DIRECT ATTENTION TO SUCH SYSTEMS, WHEN PRESENT. ARROWS ON THE TROPICAL SURFACE ANAL DEPICT VELOCITIES IN KNOTS OF LOWER CLOUDS DERIVED FROM SUCCESSIVE OBSERVATIONS BY SATELLITE.

(2) PACIFIC SURFACE ANAL MANUALLY ANALYZED AT THE WEATHER SERVICE FORECAST OFFICE IN HONOLULU DEPICT THE PRESSURE FIELD NORTH OF 15 NORTH AND STREAM LINES (NOT STREAM FUNCTION LINES) SOUTH OF 15 NORTH. WHILE THE STREAM LINES DELINEATE GENERAL DIRECTION OF WIND FLOW, THE SPACING BETWEEN THEM IS NOT INDICATIVE OF WIND SPEEDS.

(3) THE SURFACE/THICKNESS PROG CHARTS, ALSO COMPUTER GENERATED AT NMC, DEPICT 1000 MILLIBAR STREAM FUNCTION LINES (SOLID LINES) AND, CHIEFLY OF INTEREST TO METEOROLOGISTS, 1000-500MB THICKNESS (DASHED LINES).

(4) THE SIGNIFICANT CLOUD FEATURES CHARTS ARE MANUALLY PRODUCED AT WSFO HONOLULU. THEY DEPICT BROAD FEATURES OF CLOUDS BASED UPON IMAGES FROM THE VARIOUS GEOSTATIONARY AND POLAR ORBITING SATELLITES. ABBREVIATIONS USED ON THESE CHARTS INCLUDE: AC - ALTOCUMULUS; AS - ALOTSTRATUS; BKN - BROKEN; CB - CUMULONIMBUS; CC - CIRROCUMULUS; CI - CIRRUS; CS - CIRROSTRATUS; CU - CUMULUS; FEW - FEW; ISOL - ISOLATED; LYRS - LAYERS; NS - NIMBOSTRATUS; OVC - OVERCAST; SC - STRATOCUMULUS; SCT - SCATTERED; TCU - TOWERING CUMULUS; TSTM - THUNDERSTORM.

(3) THE SATELLITE IMAGES ARE INFRARED CLOUD PICTURES TRANSMITTED IN REAL TIME AS THEY ARE BEING SCANNED BY GEOSTATIONARY SATELLITE.

(4) OTHER HIGH SEAS MARINE WEATHER BROADCASTS FROM HAWAII: USCG RADIO NMO HONOLULU - SSB VOICE AT 0545, 1145, 1745 AND 2345 ON 2670 kHz, 6501 kHz, 8764 kHz, 13089 kHz. WWVH KAUAI, HAWAII - AM VOICE ON THE 48TH, 49TH, 50TH, 51ST MINUTE OF EACH HOUR ON FREQUENCIES 2.5, 5.0, 10.0, 15.0 mHz. NOAA WEATHER RADIO ON 162.55 mHz AND/OR 162.40 mHz.

(5) THESE RADIO FREQUENCIES ARE ASSIGNED FREQUENCIES. TO CONVERT TO CARRIER FREQUENCIES, SUBTRACT 1.9 kHz FROM THE ASSIGNED FREQUENCIES.

(6) YOU MAY ADDRESS COMMENTS ABOUT THIS BROADCAST TO:

REGIONAL DIRECTOR
NATIONAL WEATHER SERVICE, NOAA
P.O. BOX 50027
HONOLULU, HAWAII 96850
PHONE: 808-836-1831

(INFORMATION DATED 06/1992)

MELBOURNE, AUSTRALIA

CALL SIGNS	FREQUENCIES	TIMES	EMISSION	POWER
AXM 31	2628 kHz	CONTINUOUS	F3C	5 KW
AXM 32	5100 kHz	CONTINUOUS	F3C	5 KW
AXM 34	11030 kHz	CONTINUOUS	F3C	5 KW
AXM 35	13920 kHz	CONTINUOUS	F3C	5 KW
AXM 37	20469 kHz	CONTINUOUS	F3C	5 KW

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0000/1200	36HR SURFACE PROG (MSL)	120/576	00/12	AUST
0030/-------	AMENDED REGIONAL SIGNIFICANT WEATHER PROG	120/576	0600	RSW
-------/1230	500MB ANAL	120/576	0000	SH
0045/-------	24HR SURFACE PROG (MSL)	120/576	0000	AUST
-------/1245	36HR SURFACE PROG (MSL)	120/576	1200	IO
0100/1300	REGIONAL SIGNIFICANT WEATHER PROG	120/576	18/06	RSW
0115/-------	FACSIMILE SCHEDULE	120/576		
0130/-------	RECOMMENDED FREQUENCIES FOR AXM RECEPTION	120/576		
0200/-------	GMS NEPHANALYSIS	120/576	0000	
0215/1430	SURFACE ANAL (MSL)	120/576	00/12	AUST
0300/1500	500MB ANAL	120/576	00/12	AUST
0315/-------	250MB ANAL	120/576	0000	AUST
-------/1515	24HR SURFACE PROG (MSL)	120/576	1200	AUST
0330/1530	SIGNIFICANT WEATHER PROG	120/576	18/06	D
0400/1600	24HR 500MB PROG	120/576	00/12	AUST
0415/1615	24HR SURFACE PROG (MSL)	12 /576	00/12	AUST
0430/-------	SEA SURFACE ISOTHERMS SE AUST (WED ONLY)	120/576		SEAUST
0445/-------	250 METER ISOTHERMS SE AUST (WED ONLY)	120/576		SEAUST
0500/-------	SEA SURFACE ISOTHERMS SW AUST (WED ONLY)	120/576		SWAUST
-------/1715	250MB ANAL	120/576	1200	AUST
0530/1730	24HR 250MB PROG	120/576	00/12	AUST
0545/-------	MAX WIND/TROPOPAUSE ANAL	120/576	0000	AUST
0615/1800	GRADIENT LEVEL WIND ANAL	120/576	00/12	E
0645/1845	AMENDED REGIONAL SIGNIFICANT WEATHER PROG	120/576	12/00	RSW
0700/1900	REGIONAL SIGNIFICANT WEATHER PROG	120/576	00/12	RSW
0715/1915	SURFACE ANAL (MSL)	120/576	00/12	IO
0730/1930	24HR WIND WAVE HT (M) PROG	120/576	00/12	AUST
0745/1945	24HR SWELL WAVE HT (M) PROG	120/576	00/12	AUST
0800/2000	SURFACE ANAL (MSL)	120/576	00/12	SWP
0815/2015	SURFACE ANAL (MSL)	120/576	06/18	AUST
0830/2030	24HR 250MB HT/WIND/TEMP PROG	120/576	00/12	ASIAN
0845/2045	24HR 250MB HT/WIND/TEMP PROG	120/576	00/12	INDIAN
-------/2115	30HR 250MB HT/WIND/TEMP PROG	120/576	1800	INDIAN
0930/2130	SIGNIFICANT WEATHER PROG	120/576	12/00	D
0945/-------	36HR 250MB PROG	120/576	1200	SWP
1000/2200	30HR 250MB HT/WIND/TEMP PROG	120/576	06/18	ASIAN
1015/-------	30HR 250MB HT/WIND/TEMP PROG	120/576	0600	INDIAN
-------/2215	SURFACE ANAL (MSL)	120/576	1200	SH
1030/-------	48HR 500MB PROG	120/576	0000	SH
-------/2230	36HR 250MB PROG	120/576	0000	SWP
1045/-------	48HR SURFACE PROG (MSL)	120/576	0000	SH
-------/2245	48HR 500MB PROG	120/576	1200	SH
1100/-------	SURFACE ANAL (MSL)	120/576	0000	SH
-------/2300	48HR SURFACE PROG (MSL)	120/576	1200	SH
1115/------	SST ANAL (TUE)	120/576		E
1130/------	AMENDED SIGNIFICANT WEATHER PROG	120/576	1800	RSW
------/2330	500MB ANAL	120/576	1200	SH
1145/------	36HR COMBINED WAVE HT PROG	120/576	1200	SH
------/2345	48HR SURFACE PROG (MSL)	120/576	1200	IO

NOTES:

1. RECEPTION AREA IS SOUTHWARDS OF 10N, BETWEEN 70E & 150W.
2. AS AVAILABLE, SUMMER ONLY.
3. TRANSMITTED FROM CANBERRA VIA RAAF TRANSMITTERS.
4. SCANNING IS NOW COMPUTER GENERATED.

MAP AREAS:

AUST:	10S 090E, 10S 170E, 50S 080E, 50S 180
RSW:	EQ - 50S, 100E - 180
ASIAN:	45N - 50S, 100E - 180
INDIAN:	45N - 50S, 30E - 110E
IO:	10S - 90S, EQ - 090E - 180
SWP:	20S - 90S, 150E - 180 - 90W
SH:	10S - 90S, ALL LONGITUDES
SEAUST:	31S - 40S, 148E - 156E
SWAUST:	25S - 37S, 110E - 120E
D:	43S 110E, 36S 155E, 36N 142E, 29N 096E
E:	23N 100E, 23N 170E, 25S 100E, 25S 170E
NEPHA :	EQ 080E, EQ 160W, 60S 080E, 60S 160W

(INFORMATION DATED 11/1992)

PEARL HARBOR, HAWAII, U.S.A.

CALL SIGN	FREQUENCIES		TIMES		EMISSION	POWER
NPM	4855	kHz	0600-1600*	LSB/ISB	F3C	
	6453	kHz	CONTINUOUS&	USB/ISB	F3C	
	8494	kHz	CONTINUOUS#		F3C	
	9090	kHz	CONTINUOUS&	USB/ISB	F3C	
	21735	kHz	1600-0600*	LSB/ISB	F3C	

* PEARL HARBOR FREQUENCIES # ADAK, AK FREQUENCY & STOCKTON, CA FREQUENCY

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0000/------	FFAX SCHEDULE PART 1 (WED & SAT)	120/576		
	SEA SURFACE TEMP ANAL (HAWAII AREA) (SUN)	120/576	---/12	6
	SEA SURFACE TEMP ANAL (SWPAC) (MON)	120/576	---/12	7
	STORM TRACK (TUE)	120/576	---/---	8
	SEA SURFACE TEMP ANAL (SOCAL) (THU)	120/576	---/12	9
	SONIC LAYER DEPTH (WPAC) (FRI)	120/576	---/12	1
-------/1200	48HR SIGNIFICANT WAVE PROG (EPAC)	120/576	00/---	2
0015/-------	FFAX SCHEDULE PART 2 (WED & SAT)	120/576		
	SEA SURFACE TEMP ANAL (NOCAL) (SUN & THU)	120/576	---/12	10
	SEA SURFACE TEMP ANAL (NWPAC) (MON)	120/576	---/12	11
	SATELLITE IMAGERY (GMS B-SECTOR) (TUE)	120/576	---/21	
	SONIC LAYER DEPTH (EPAC) (FRI)	120/576	---/12	2
-------/1215	SATELLITE IMAGERY (GOES C-SECTOR IR)	120/576	1159	
0030/-------	SATELLITE IMAGERY (GOES C-SECTOR VISUAL)	120/576	2359	
-------/1230	36HR SURFACE PROG (S HEM)	120/576	---/12	
0045/1245	SIGNIFICANT WAVE ANAL (POLAR)	120/576	12/00	3
0100/1300	12HR SURFACE PROG (POLAR)	120/576	00/12	4
0115/1315	24HR SURFACE PROG (POLAR)	120/576	12/00	4
0130/1330	24HR 850MB PROG (EPAC)	120/576	12/00	2
0145/1345	24HR 700MB PROG (EPAC)	120/576	12/00	2
0200/1400	24HR 400MB PROG (EPAC)	120/576	12/00	2
0215/1415	24HR 300MB PROG (EPAC)	120/576	12/00	2
0230/1430	24HR SIGNIFICANT WAVE PROG (WPAC) (2)	120/576	00/12	1
0245/1445	SATELLITE IMAGERY (GMS B-SECTOR)	120/576	2331/1131	
0300/1500	48HR SIGNIFICANT WAVE PROG (WPAC)	120/576	12/00	1
0315/1515	24HR 850MB PROG (WPAC)	120/576	12/00	1
0330/1530	PRELIM SURFACE ANAL (EPAC)	120/576	00/12	2
0345/1545	PRELIM SURFACE ANAL (WPAC)	120/576	00/12	1
0400/1600	24HR 700MB PROG (WPAC)	120/576	12/00	1
0415/1615	24HR 400MB PROG (WPAC)	120/576	12/00	1
0430/1630	24HR 300MB PROG (WPAC)	120/576	12/00	1
0445/1645	24HR SIGNIFICANT WAVE PROG (POLAR)	120/576	12/00	3
0500/1700	48HR SIGNIFICANT WAVE PROG (POLAR)	120/576	12/00	3
0515/-------	24HR 500MB SL PROG (POLAR)	120/576	12/---	3
-------/1715	72HR SURFACE PROG (EPAC)	120/576	---/00	2
0530/-------	48HR 500MB SL PROG (POLAR)	120/576	12/---	3
-------/1730	72HR SURFACE PROG (WPAC)	120/576	---/00	1
0545/1745	TROPICAL WARNINGS/OPEN PERIOD	120/576	---/---	
0600/-------	SATELLITE IMAGERY (GOES C-SECTOR IR)	120/576	0529	
-------/1800	SATELLITE IMAGERY (GOES C-SECTOR VISUAL)	120/576	1729	
0615/1815	FINAL SURFACE ANAL	120/576	00/12	5
0700/1900	500MB ANAL (EPAC)	120/576	00/12	2
0715/1915	500MB ANAL (WPAC)	120/576	00/12	1
0730/1930	24HR SURFACE PROG (EPAC)	120/576	00/12	2
0745/1945	24HR SURFACE PROG (WPAC)	120/576	00/12	1
0800/2000	48HR SURFACE PROG (EPAC)	120/576	00/12	2
0815/2015	48HR SURFACE PROG (WPAC)	120/576	00/12	1
0830/2030	36HR SURFACE PROG (EPAC)	120/576	12/00	2
0845/2045	36HR SURFACE PROG (WPAC)	120/576	12/00	1
0900/-------	SATELLITE IMAGERY (GOES C-SECTOR IR)	120/576	0859	
-------/2100	SATELLITE IMAGERY (GOES C-SECTOR VISUAL)	120/576	2031	
0915/2115	PRELIM SURFACE ANAL (EPAC)	120/576	06/18	2
0930/2130	PRELIM SURFACE ANAL (WPAC)	120/576	06/18	1
0945/2145	24HR 500MB PROG (EPAC)	120/576	00/12	2
1000/2200	24HR 500MB PROG (WPAC)	120/576	00/12	1
1015/2215	48HR 500MB PROG (EPAC)	120/576	00/12	2
1030/2230	48HR 500MB PROG (WPAC)	120/576	00/12	1
1045/-------	SATELLITE IMAGERY (GMS B-SECTOR)	120/576	0928	
1100/2245	36HR SURFACE PROG BLEND	120/576	12/00	1
1115/2300	OPEN PERIOD			
1130/2315	SIGNIFICANT WAVE ANAL/36HR PROG (EPAC)(2)	120/576	00/12	2
1145/2330	24HR SIGNIFICANT WAVE PROG (EPAC)(2)	120/576	00/12	2
-------/2345	48HR SIGNIFICANT WAVE PROG (EPAC)(2)	120/576	---/12	2

PEARL HARBOR, USA CONTINUED

MAP AREAS: CHART PROJECTION ASSUMES A 19 INCH RECORDER.

1 -	1:13,000,000	60N 123E, 60N 162W, 05N 123E, 05N 162W
2 -	1:13,000,000	60N 168W, 60N 093W, 05N 168W, 05N 093W
3 -	1:05,000,000	38N 100E, 42N 080W, EQ 160E, EQ 140W
4 -	1:05,000,000	55N 110E, 60N 090W, 30N 165E, 28N 140W
5 -	1:13,000,000	60N 150E, 60N 110W, 05N 150E, 05N 110W
6 -	1:05,000,000	12N 170W, 40N 170W, EQ 145W, 30N 135W
7 -	1:05,000,000	EQ 170E, 34N 160E, 05N 165W, 38N 165W
8 -	1:13,000,000	60N 110E, 60N 115W, EQ 110E, EQ 115W
9 -	1:05,000,000	25N 135W, 45N 120W, 15N 120W, 25N 105W
10 -	1:05,000,000	35N 170E, 65N 170W, 30N 140W, 50N 115W
11 -	1:05,000,000	30N 160E, 50N 135W, 30N 165W, 65N 165W

NOTES:

1. CONTENTS OF THIS SCHEDULE MAY CHANGE WITHOUT NOTICE DUE TO U.S. NAVY OPERATIONAL REQUIREMENTS.
2. ARROW HEADS INDICATE PRIMARY DIRECTION, ARROW TAILS INDICATE SECONDARY DIRECTION.
3. COMMENTS CONCERNING QUALITY AND CONTENT ARE SOLICITED. ADDRESS COMMENTS TO:
   NAVAL WESTERN OCEANOGRAPHY CENTER
   BOX 113
   PEARL HARBOR, HI 96860-5050 U.S.A.

(INFORMATION DATED 11/1992)

KODIAK, ALASKA, U.S.A

CALL SIGN	FREQUENCIES	TIMES	EMISSION	POWER
NOJ	4298 kHz		F3C	
	8459 kHz		F3C	

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID	MAP TIME	AREA
0400	SURFACE ANAL		120/576	0000	
	ALASKA COASTAL MARINE FORECAST TABLES		120/576	12/00	
	DAY-3 SURFACE PROG		120/576	1200	
	DAY-4 SURFACE PROG		120/576	1200	
	DAY-5 SURFACE PROG		120/576	1200	
1000	SURFACE ANAL		120/576	0600	
	36HR SURFACE PROG		120/576	1200	
	5-DAY SEA ICE PROG		120/576	LATEST	
	SEA SURFACE TEMP/MIXED LAYER DEPTH/ ICE EDGE (3)	120/576	LATEST		
1800	SURFACE ANAL		120/576	1200	
	ALASKA COASTAL MARINE FORECAST TABLES		120/576	00/12	
	FAX SCHEDULE (2)		120/576		
2200	SURFACE ANAL		120/576	1800	
	36HR SURFACE PROG		120/576	1200	
	18HR SIGNIFICANT WAVE PROG	120/576	1200		
	SEA ICE ANAL		120/576	LATEST	

NOTES:

1. EACH MAP TAKES 10 MINUTES TO SEND AND MAY NOT ALWAYS BE SENT IN THE SEQUENCES SHOWN ABOVE. IF A PARTICULAR MAP IS MISSING, A NOTE WILL BE SENT AT THE END OF TRANSMISSION..
2. MONDAY,WEDNESDAY AND FRIDAY.
3. WEDNESDAY ONLY, OCTOBER-FEBRUARY.
4. THIS BROADCAST ORIGINATES FROM THE NATIONAL WEATHER SERVICE. COMMENTS AND SUGGESTIONS SHOULD BE DIRECTED TO:
   OFFICIAL IN CHARGE
   NATIONAL WEATHER SERVICE/NOAA
   BOX 37, U.S.C.G. BASE
   KODIAK, AK 99619

(INFORMATION DATED 01/1992)

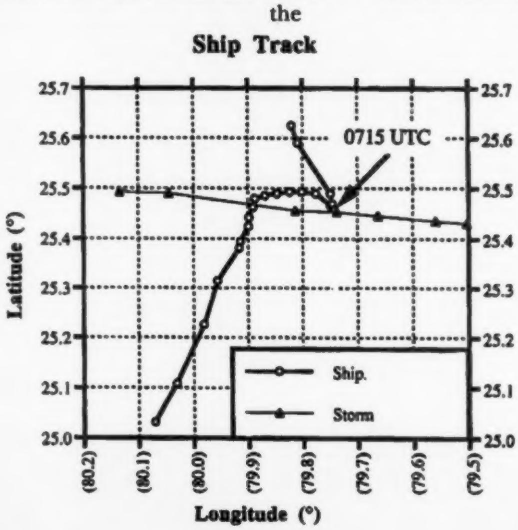
Through the Eye of Andrew

S.H. Houston, F.D. Marks and P.G. Black
Hurricane Research Division / AOML / NOAA
Miami, FL 33149

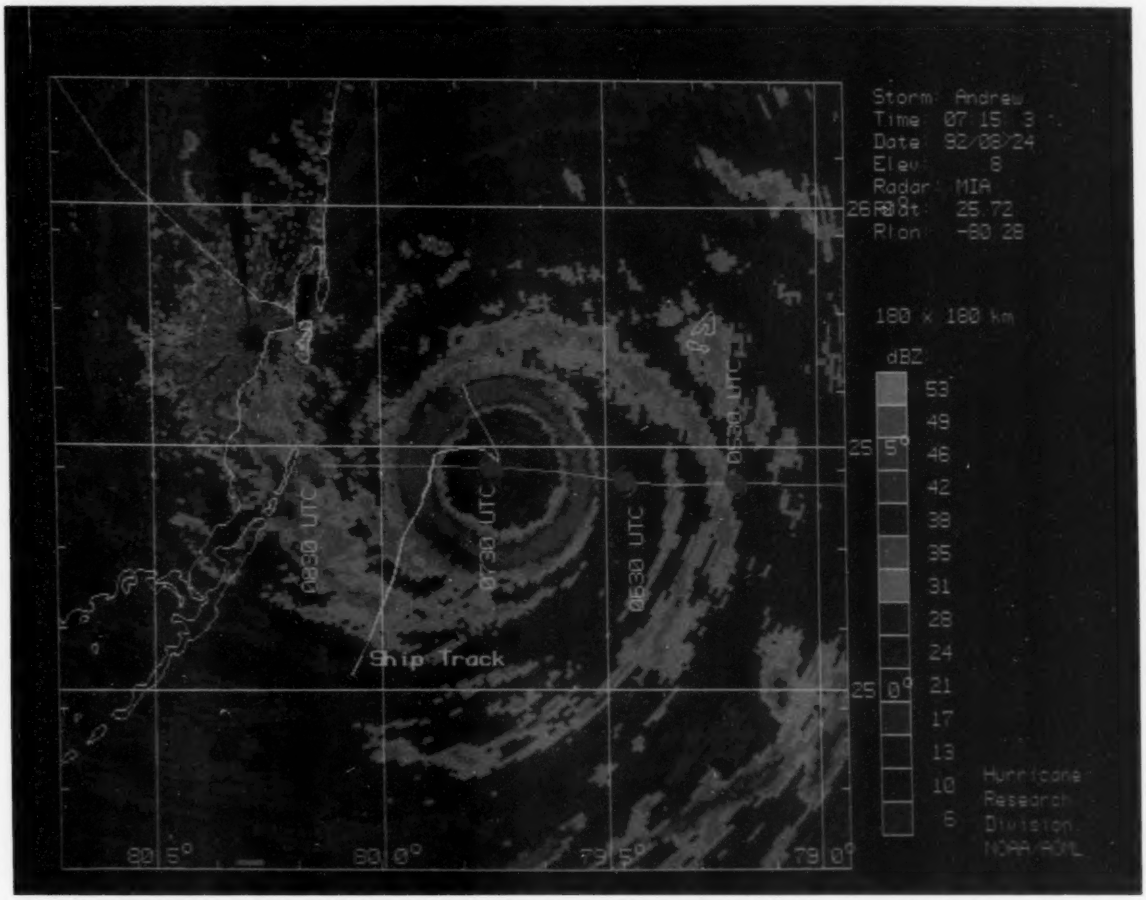
Before a raging Hurricane Andrew took out Miami's National Weather Service Radar on August 24, 1992, scientists from NOAA's Hurricane Research Division were analyzing what seemed like predictable patterns. The team had been deployed to record National Weather Service (NWS) radars during hurricane landfalls. While one of these teams recorded the WSR-57 radar at the Miami NWS Forecasting Office (collocated with the National Hurricane Center, NHC), a second team recorded at the Tampa Bay NWS office in Ruskin, Florida. The Miami NWS radar was operative until shortly before landfall at approximately 0900 UTC on the 24th when the radome was breached, and the radar later detached from its pedestal.

The Miami radar data, as well as the data from the Tampa Bay NWS radar, showed the normal ground clutter around the radar and the radar echoes associated with the hurricane. In addition to the expected, there were echoes from other sources—planes and marine vessels which were evacuating the area prior to Andrew's landfall.

However, there appeared to be one large ship, moving through Andrew's eye while attempting to pass in front of the storm. The team used positions to calculate the vessel's speed and heading. During the first half-hour after 0230 UTC on the 24th, the ship seemed to be moving north-northeastward at 11 to 17 knots. It then moved at about 6 to 8 knots toward the north-northeast from 0300 to 0500 UTC. Radar echoes associated with Hurricane Andrew indicated that the ship began to encounter outer rainbands west of the storm at approximately 0440 UTC. The ship's estimated speed had slowed to 4 to 6 knots and the heading had changed to east-northeastward by 0500 UTC. This change in forward motion of the ship was probably in response to the increasing seas and wind. The team determined the vessel's track in the storm— relative coordinates from 0600 to 0830 UTC superimposed on the Hurricane Andrew radar image at 0715 UTC. The vessel's course shifted eastward during the period 0530 to 0630 UTC and, by about 0630 UTC, the ship entered the eye



Ship's track in earth-relative coordinates, as well as Hurricane Andrew's center on the 24th of August 1992. At times the ship was lost in the intense radar reurn from Andrew's eye wall.

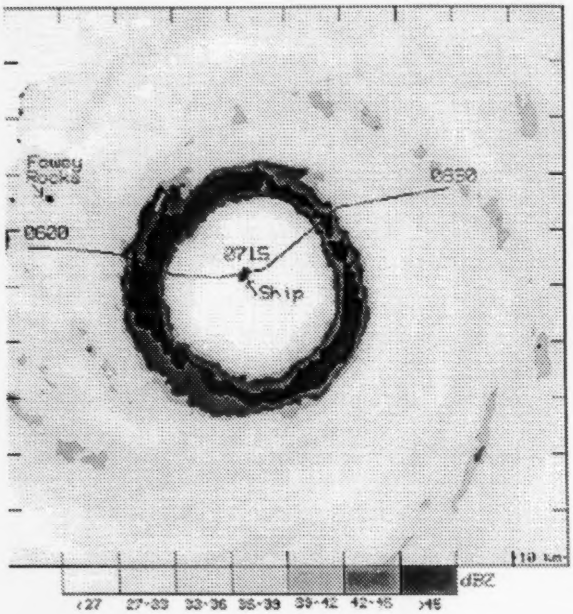


The MC Gem's track through the eye of Hurricane Andrew is plotted and superimposed on the Miami Radar's view of Andrew at 0715 UTC on the 24th of August. This was during the time that the vessel was in the eye.

wall and was no longer discernible from the intense radar echoes in Andrew's eye wall. The ship reappeared inside of the eye at approximately 0700 UTC, and then displaced southward from its previous location at 0630 UTC. This southern displacement was probably due to the strong northerly winds and high seas along the inside of the eye wall. The echo–free, relatively calm region of the eye moved across the vessel and after encountering the northeast eye wall at 0740 UTC, the ship reemerged northeast of the eye wall and began moving away from the storm. The ship continued moving away from the storm before the Miami NWS radar failed at 0840 UTC.

HRD and NHC wanted to identify and locate this mystery ship, because any logs containing wind and barometric pressure readings, as well as sea conditions, would be useful in documenting Hurricane Andrew's surface conditions just before landfall. Based on U.S. Coast Guard and local media information, it was determined that the ship in question, the ***M.C. Gem*** (a 521–foot merchant ship registered in Nassau, The Bahamas), was the vessel that was visible on NWS radar as it passed through Hurricane Andrew's eye. Apparently none of the crew members on board the ship were seriously injured, but the ship reportedly was damaged during the storm and sought assistance in a port along the Florida coast during the afternoon of the 24th. The freighter remained in port for repairs for nearly 8 weeks before proceeding to Louisiana to load cargo.

In Louisiana, New Orleans Port Meteorological Officer (PMO), Jack Warrelmann, visited the ship to obtain any meteorologi-

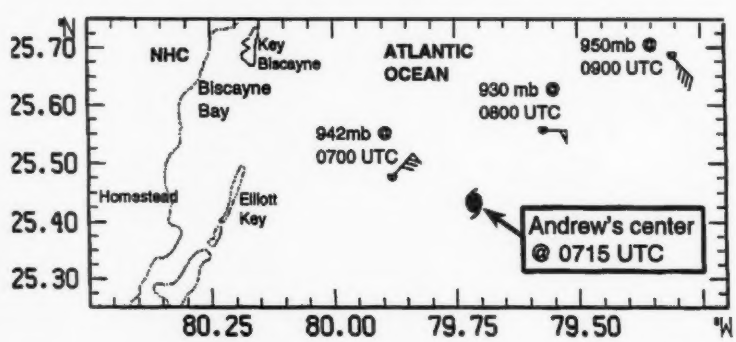


The ship's track in storm-relative coordinates between 0600 and 0830 UTC is superimposed on Hurricane Andrew's radar echoes at 0715 UTC. Note the location of the ship inside of the eye and the echo for Fowey Rocks C-MAN station.

cal information pertaining to Hurricane Andrew. The ship's barometer had last been calibrated by Warrelmann, then PMO in Newark, NJ in early 1991 (+6 mb offset) and he found that a correction of +11.1 mb was required when he "zeroed" the instrument during his visit. Only a handheld anemometer was found on board, so it was unlikely that the crew made actual wind measurements during their encounter with Andrew. PMO Warrelmann found that none of the original crew members were on the freighter while it was in Louisiana, but excerpts from a log were obtained. The log was kept at 2-hour intervals, except during the passage through the worst part of the hurricane when it was maintained hourly. The wind speeds were recorded as Beaufort estimates (highest reported was 12 or hurricane force at 0700 UTC) and barometric pressure readings were recorded in millibars (the ship's barometer had scales in millibars and millimeters of Hg). The lowest pressure noted was 930 mb at 0800 UTC, but there is no indication as to whether there was a correction of 6 mb had been applied to this reading. Also, because at 0800 UTC the vessel was located in the northeastern eye wall according to the NWS radar, it is unlikely that this was the lowest pressure experienced by the ship's crew. The ship was in the eye for 40 to 45 minutes (Air Force reconnaissance aircraft reported a minimum pressure of 932 mb at approximately the same time). Wave heights were also given in these excerpts from the log, but the units used are unknown.

Acknowledgments:

Special thanks go to the Hurricane Reseach Division radar teams—Peter Dodge, Paul Leighton, Michael Black, and Bret Christoe. Bryan Norcross of station WTVJ in Miami, Florida, and reporters from *The Miami Herald* and the Associated Press announced our need for information on this ship to the public, without which it is unlikely we would have located the ship or its log. The U.S. Coast Guard provided valuable information about the vessel during and after its passage through Andrew. Warren Krug of AOML and Bob Novak, the PMO in San Francisco, provided additional information.



The 0700, 0800, and 0900 UTC observations from the ship's log in storm-relative coordinates centered at 0715 UTC. The wind speeds are Beaufort estimates (the wind speeds were likely higher based on other surface observations made in the vicinity of Andrew). The barometric pressure values in millibars are those recorded; it is unknown if an offset was applied to these pressure measurements.

MC Gem and NWS Miami Radar on August 24, 1992

Time (UTC)	Latitude	Longitude	Comments
0230	25° 02'N	80° 04'W	Southeast of Carysfort Light
0430	25° 23'N	79° 57'W	West of storm center
0715	25° 28'N	79° 45'W	Center of eye

Time (UTC)	
0254-0400	Little or no rain
0400	Encounters first outer rainband, vessel slows considerably
0440-0500	Inside big outer rainband
0500-0545	Occasional small rainbands
0545-0630	Lull in rain bands, west of eyewall vessel nearly stationary
0630-0700	Enters eyewall, vessel not discernable on radar image
0700-0740	Inside of eye, begins moving north after being displaced to south during passage through eyewall
0740-0810	Leaves eye heading north through east eyewall
0840	Radar fails

NOAA's Hurricane Research Division and National Hurricane Center are very interested in any meteorological and oceanographic measurements made during Hurricane Andrew. If you have such information or can lead us to any crew members who were on the ship ***M.C. Gem*** on August 24, 1992, please contact:

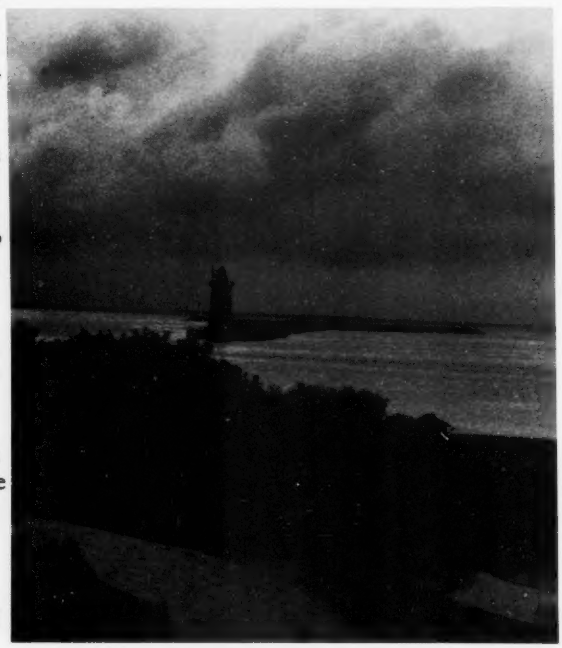
Sam Houston
NOAA/AOML
Hurricane Research Division
4301 Rickenbacker Causeway
Miami, FL 33149
Phone: 305-361-4509
Fax: 305-361-4402

North Atlantic Weather July, August, and September 1992

July— The number of low pressure systems that moved between the Canadian Maritimes and Iceland resulted in an Icelandic Low centered off Kap Farvel in a month when this feature is usually hard to find on the climatic charts. As a consequence, the Azores–Bermuda High was squeezed southeastward.

The month opened with the weather map looking like the climatic chart for the month. A large Azores–Bermuda High stretched from the Gulf of Mexico to the Bay of Biscay while several smaller Lows traversed a pipeline from Newfoundland to England. There was enough of a pressure gradient on the 1st for a couple of vessels in the vicinity of 45°N, 45°W to encounter winds in the 40–kn range. The High then wedged its way northward over the British Isles forcing the Lows toward the Norwegian Sea and Denmark St. Most of these systems were weak and produced little in the way of severe weather. By the 8th, the High was at 1036 mb and centered near 40°N, 30°W. It finally weakened somewhat on the 14th, and several identifiable Lows were analyzed south of Greenland. The southernmost storm became dominant and developed a 974–mb center by 1200 on the 15th near 50°N, 35°W. The *ELE3* (41°N, 46°W) at 0000 on the 15th reported a 45–kn westerly in 17–ft seas while the *Yuozas Vareykis* (47°N, 46°W) hit 41–kn northwesterlies in 17–ft seas. The *Zador* measured 45—kn winds nearby. Moving northeastward the storm continued to create problems in the shipping lanes for the next few days. On the 17th it jogged westward for a time before returning to a northeasterly track that took it into the Norwegian Sea by the 21st.

On the 25th, a 1030–mb High was centered over the mid Atlantic with a moderate 988–mb Low sitting south of Iceland. The second tropical depression of the North Atlantic season was spotted near 29°N, 63°W, but did **not** develop into Andrew. Another bad weather–producing Low came off Newfound-



Joe Shaw

This view of the entrance to Delaware Bay reflects the summer conditions along the mid Atlantic coast in 1992. For example, for a 24–hr period on the 16th–17th of August more than 3.5 in of rain fell over lower Delaware. When it wasn't raining, it was most likely cloudy, and some reports from the coast are calling 1992 the year without a summer.

land on the 26th, and by the 28th was centered just west of Iceland with a 990-mb pressure. Winds of 40 to 45 kn were common in the immediate vicinity of the storm center. At 0000 on the 28th, the ***Yuozas Vareykis*** measured 50-kn winds near 59°N, 36°W in 21-ft seas. The storm moved across Iceland and weakened on the 30th.

Casualties— The bulk carrier ***Mesabi Miner*** sustained a 30-ft gash just aft of the bow when it grounded, reportedly in fog, on the 13th in St Mary's River just below the entrance to Sault Ste Marie Harbor.

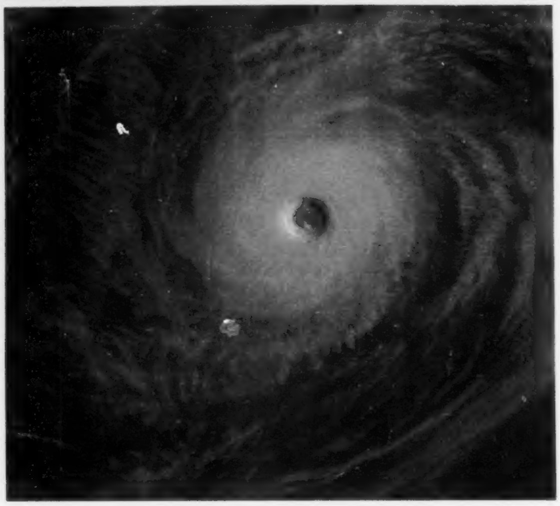
One of the few extratropical storms to show some organization (left) was discovered on the 3rd of August, south of Greenland. This NOAA visible photograph was taken at about 1600.

August— Hurricane Andrew went unnoticed on the climatic chart for the month, while the Icelandic Low which usually goes undetected was once again analyzed south of Iceland like last month. Its 1000-mb center is reminiscent of a winter situation. This is a reflection of the preponderance of 980 mb and 990 mb storms which moved zonally south of Iceland and continued on between Scotland and the Faeroe Islands. The large Azores—Bermuda high was even more potent than normal.

The month opened with a large 1030-mb High dominating most of the North Atlantic and several weak Lows north of 50°N, strung out along a front that stretched from the Gulf of Maine to the northern Norwegian Sea. While these systems were producing weather over the northern shipping lanes, it was usually winds in the 20-to 25-kn range with seas less than 10 ft. Occasionally there was an indication of a brief worsening of conditions, such as the report from the ***FNGH*** (53°N, 55°W) which encountered 43-kn winds. The first week of the month saw a progression of Lows move from south of Iceland into the North Sea while the Azore-Bermuda High continued to hold firm.

On the 15th a 970-mb Low was analyzed between Kap Farvel and Iceland. This system had its origins west of Great Slave Lake in Canada's Northwest Territory on the 6th. It moved across James Bay on the 10th as a 993-mb Low and its deepening 988-mb center moved off Labrador on the 12th. At 0300 on the 14th, the ***OWDD*** (63°N, 51°W) ran into a 58-kn north northwesterly, while later in the day the ***P3PE2*** battled 40-kn winds in 13-ft seas. By the 16th, the system began to weaken as it turned a counterclockwise loop just southwest of Iceland. This move took 4 days. By the time this storm washed out, on the 20th, another Canadian Low had moved into the picture. It was also in the process of turning a counterclockwise loop south of Iceland, and it was intensifying. By the 23rd, it had just about completed the loop and stalled with a central pressure of 984 mb just 250 mi south of Iceland. The ***Arni Fridriksson*** (67°N, 22°W) reported 58-kn westerlies on the 24th. That same day the ***Valdivia*** (56°N, 20°W) ran into 40-kn southwesterlies in 20-ft swells. The storm began to move on the 25th but weakened as it made its way across Scotland the following day. This all took place as Andrew was pounding Florida and the Gulf of Mexico. The extratropical portion of Andrew was tracked across New York State and into Quebec Province before turning out to sea off Labrador on the 31st as a 991-mb Low. There is more

Satellite Data Services Division



Satellite Data Services Division

Hurricanes Bonnie and Charley, while not getting the notoriety that accompanied Andrew, were nontheless a real threat to shipping and to the Azores. Within less than a week, toward the end of September, both hit the Azores. While they were at less than hurricane strength, they still caused some damage and their hurricanes stages caused problems for ships along the routes from the U. S. East Coast to the Mediterranean. The photo of Bonnie (left) was taken on the 24th, while Charlie was spotted on the 30th.

on Andrew inside this issue. Andrew was also featured in *Mariners Weather Log* Fall issue and will also be covered in the upcoming Spring issue.

Casualties— In heavy fog the ro ro mv ***Goya*** and the chemical tanker ***Rita*** collided in Ceuta Roads, located at the east end of the Strait of Gibraltar. A 45–m British construction barge broke adrift in severe weather off Bacton and finally beached and ruptured in several places. The three people onboard were rescued by helicopter. During Hurricane Andrew more than 100 platforms off the coast of Louisiana were either damaged, destroyed or missing. In St Francisville, 30 mi. north of Baton Rouge six crewmembers on the tug ***Bonnie Harrison*** were rescued when the vessel sank in the Mississippi River. The container vessel ***Puritan*** collided with the bulk carrier ***Navios Enterprise*** off the Louisiana coast on the 25th. Both suffered extensive damage. The dredger ***Allan-Judith*** grounded, and the tug ***Sandy Cay*** sank at Ocean Cay in the Bahamas.

During Hurricane Lester the MV ***Gladiator*** lost 10 containers near 25°N, 113°W.

September— This month can be dangerous in the North Atlantic with tropical cyclones frequencies at their peak in the tropics and subtropics while extratropical storms and remnants of hurricanes pose a threat to shipping in northern waters. This September had a little of both. While the U.S. mainland felt only minimal effects from tropical storms Danielle and Earl, shipping had to contend with not only these storms but Hurricanes Bonnie and Charley which haunted the waters between Bermuda and the Azores. A 1004–mb Icelandic Low on the climatic charts reflected the extratropical activity between Greenland and England.

Early in the month a 976–mb Low hovered just north of Scotland. Over the North Sea and off the Hebrides winds blew at 40 to 45 kn while seas ran 10 to 17 ft. This system trudged northward and was replaced by a second Low from the mid Atlantic on the 2nd. This one cut across Scotland and moved into the North Sea. There were a few 45– to 50–kn wind reports in the North Sea and English Channel on the 3rd. On the other side of the Atlantic, a moderate Low had formed over the Gulf of St Lawrence and was affecting weather over the Grand Banks during the first few days of the month. For the most part, however, winds remained below gale force. Farther inland a potent Low had formed over northern Hudson Bay during this first week in September. By the 4th its central pressure dipped to 976 mb as it turned a counterclockwise loop in the bay. When it finally did decide on a direction of

movement, it headed eastward onto the Davis St and then turned northward to Baffin Bay.

On the 7th a 979-mb Low was analyzed just south of Iceland with a circulation that extended over England and across the English Channel. This merged with a system that had developed over the mid Atlantic and the combined systems caused problems over the North and Norwegian Seas for several days. The most affected area during the period extended from the North Sea and Norwegian Sea westward to about Iceland. In these waters, winds were generally 40 to 45 kn with seas running 15 to 30 ft. There were numerous excellent reports from both ships and platforms, which enabled forecasters to get a good handle on the situation.

A storm which had formed off Cape Cod on the 4th, ended up as a 980-mb Low over the Faeroe Islands on the 12th. It had not really intensified until the 10th, when it turned northward and brushed Ireland and Scotland. Once again these waters were whipped by 40- to 50-kn winds. Seas up to 25 ft were being encountered. At 1200 on the 12th, ***Platform 63115*** (60°N, 4°W) measured 50-kn winds with seas of 25 ft. At 1800 the same day the ***FNBR*** (51°N, 7°W) ran into 48-kn winds in 14-ft seas.

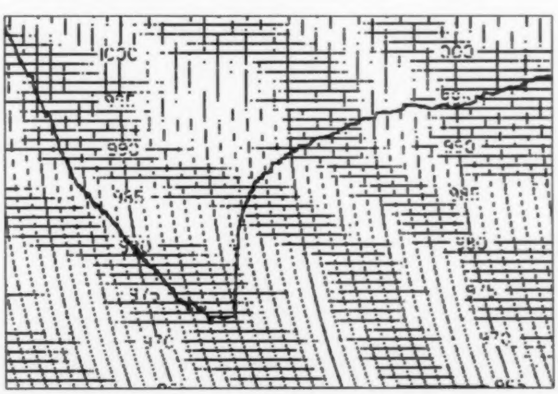
This trend of systems developing in the west and intensifying in the east continued when a Low south of Cape Codon the 12th intensified to 984 mb on the 14th as it crossed the 55th parallel near 30°W. The following day it made a beeline for the Faeroe Islands. On the 17th a 979-mb Low was spotted near 60°N, 30°W. A buoy off Greenland measured a 54-kn wind at 1200 on the 16th and the ***Walther Herwig*** measured 45 kn near 65°N, 33°W at 1500 on the 17th. This storm turned a small counter clockwise loop on the 18th and slowly meandered toward the Denmark St over the next several days.

By the 19th Bonnie was a hurricane near 35°N, 57°W. The system took a meandering track toward the east northeast and ended up over the Azores as the month came to an end. In the meantime, Charley, Danielle and Earl all came to life. Only Charley reached hurricane strength, and it moved through the Azores on the 27th just 3 days before the arrival of Bonnie. Fortunately neither was a hurricane at the time, but they still caused plenty of damage to the islands. Charley was on a parabolic track and by the 29th was a 980-mb extratropical Low near 59°N, 22°W. It combined with another system to the northwest and created a large multi-centered storm covering a good portion of the northeast North Atlantic, with Bonnie to the south adding fuel to the fire. Gales were common in these waters.

Casualties—The bulk carrier Clipper Alliance and a 79-ft fishing vessel, the ***St. Kilda*** were involved in a collision on the 6th near 58°N, 6°W in near gales and rain squalls. The fishing vessel suffered extensive damage. The Azores suffered from both Bonnie and Charley. On the 26th and 27th Charley generated wind gusts up to 65 kn in the Azores. Terceria Is was most affected and six fishing vessels sank while sheltered in the inner port of Praia da Vitoria. The islands suffered damage to houses, crops, roads, and communication equipment in both storms. During Bonnie one man was killed by rockfall on the island of St Michaels, which was the hardest hit during this storm. Winds of 54 kn were reported.

The Atlantic oiler ***Leroy Grumman*** rescued two fishermen from the ***Captain Jake*** off St. Augustine, FL late in the month. Winds were 40 to 45 kn and seas ran 8 to 12 ft at the time. The rescue was further hampered by shallow water, which prevented the ***Grumman*** from getting closer than 1.7 mi to the foundering fishing vessel. The Military Sealift Command vessel launched a rigid hull inflatable boat in order to rescue the fishermen. Last June the ***Grumman*** rescued four German sailors from the ***Elkahe II*** in the Mediterranean Sea.

On the 28th the 35-ft sailboat ***Katsura*** enroute from Martha's Vineyard to the Washington, DC area ran into Tropical Storm Danilelle off the New Jersey coast. They had evidently strayed some 75 mi off course and got too close to the coast. They were driven aground at Island Beach during the night by easterly 30-kn winds and 10-ft seas. Two of the four crew members were washed overboard and drowned while two survived.



*The **Madison Maersk** enroute to England ran into a storm on the 11th of September between Rotterdam and Bremerhaven. Looks like the one that formed off Cape Cod on the 4th and brushed past Scotland on the 10th. Their lowest pressure reached 972 mb.*

All times unless noted are UTC (universal time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports and attempt to highlight the most significant ocean features each month. The track charts are provided by NOAA's National Meteorological Center. If an extratropical storm is particularly bad for shipping, we may designate it as the Monster of the Month. The Gale Tables, provided by the National Climatic Data Center at Asheville, NC, have been expanded to include U.S. ships reporting winds of 34 knots or more.

North Pacific Weather July, August, and September 1992

July— On the mean pressure chart the North Pacific looked like a typical summer month. The large subtropical high prevailed and was very nearly normal. About the only pressure anomalies were 2 mb departures— positive in the northeastern North Pacific and western tropics and negative in the eastern tropics.

The eastern North Pacific tropics were the scene of a flurry of tropical cyclone activity in July. Hurricane Celia was already in action when the month opened. It was followed by Hurricanes Darby, Estelle, Frank, and Georgette. Five tropical cyclones formed in the western North Pacific, including Tropical Storms Fay, Gary, Helen, and Irving along with Typhoon Eli.

As the month opened a 983–mb Low northeast of Tokyo was generating winds up to storm force (50 kn) west and southwest of its center, where the ***President Jefferson*** and the ***Morelos*** encountered 40–kn winds while the ***Green Lake*** (38°N, 148°E) measured 49–kn winds at 0000 on the 1st. Seas were running about 6 to 12 ft. By 0000 on the 2d pressure had dropped to 978 mb. At 0900 the ***JKCQ*** reported 200–yd visibility in heavy rain with 44–kn winds and a 982–mb pressure near 41°N, 149°E. The storm remained intense as it headed east northeastward gradually turning toward the north northeast on the 3d. It moved into the Bering Sea and weakened the following day.

Tropical cyclones took center stage for the next few weeks. Not that there was no extratropical activity, but most of it was of the weak, short–lived variety along and just south of the Aleutians. In the western North Pacific, Eli started as a tropical depression on the 9th. The ***Arafura*** (15°N, 127°E) measured 50–kn winds in 20–ft seas at 1200 on the 10th. On the 11th the ***ACX Lotus*** (14°N, 119°E) ran into 52–kn winds. By the time

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This photo from the 2nd of July shows the faint outline of the extratropical storm which was creating problems for shipping in the northwest North Pacific. The associated frontal system trailing to the south is a lot more dramatic.

Eli battered central Luzon on the 11th, it had attained typhoon strength. The mountains of Luzon weakened it, but once in the friendly confines of the South China Sea, it regained typhoon status. Eli swept across Hainan on the 13th and dissipated over Vietnam the following day.

On the 16th, several atmospheric waves were analyzed along a frontal boundary which stretched across most of the Pacific between 35°N and 45°N. Two of these waves combined into a 996-mb Low on the 18th near 45°N, 167°E. The pressure gradient was strong enough to generate gale force winds in the area as testified to by the ***Admiral*** 46°N, 163°E) at 0000 on the 19th, which measured 40-kn winds. The storm continued to move north northeastward into the Bering Sea retaining it identity until the 22d when it moved across the Alaskan Peninsula.

Casualties— In Hong Kong the Greek container vessel ***Inchon Glory*** was driven aground on the 17th while a barge was driven aground near Tsing Vi Is. Also in Hong Kong two people were reported killed and 11 injured during the passage of Faye. During Eli 14 passengers were injured when a hydrofoil hit a pier in Hong Kong. Several people drowned in the Philippines in floods caused by Tropical Storm Gary. The Vietnamese vessel ***Song Cam 02*** with 18 aboard and a deck load of cars were beached on Stonecutter Is on the 22nd. It was later refloated. The bulk carrier ***Dominator*** sustained heavy weather damage during Gary on the 22nd.

August—Except for the Bering Sea, the North Pacific region experienced a fairly normal month according to the climatic charts. There was enough cyclonic activity in the Bering Sea extending just south of the Aleutians to result in negative pressure anomalies and an Aleutian Low on the mean pressure chart. In the tropics the parade of tropical cyclones continued in both the eastern and western regions. By the month's end western names were down to Omar while the east had reached Newton.

During the first week of the month a large, amorphous multi-centered Low extended from the Ryukyu's to the Alaskan Peninsula. A large subtropical high was located to the south and it eastern edge pushed northward into the Gulf of Alaska. In the tropics Irving, Janis, Kent, and Javier were in various stages of development. By the 5th, the northern Lows had organized into one or two definable centers over and east of the Alaska Peninsula. It moved into the Gulf of Alaska for a few days while in the tropics, Janis and Kent had become typhoons and Javier was a hurricane. The ***Matsura Maru*** some 120 mi southeast of the eye of Janis, at 0000 on the 6th, measure 43-kn southerlies and 200-yd visibility in blowing spray while battling 13-ft swells. A few hours later they ran into moderate rain as well. At 0000 on the 7th, the ***Ganga Sagar*** (25°N, 128°E) hit 55-kn north northwesterlies in heavy rain and 26-ft swells. Janis maintained typhoon strength until the 9th after clobbering Japan. Its extratropical remnants caused some weather problems to shipping on the 10th when its 995-mb center moved across the southern Ryukyus. After moving northward through the Sea of Okhotsk, it moved eastward through the Bering Sea as a weak Low. By the 12th, Kent (22°N, 146°E) was at super typhoon strength (winds > 130 kn). On the 15th at 0600 the ***Shirotae Maru*** (27°N, 143°E) measured 61-kn east southeasterlies and 1/4 mi visibility in 17-ft swells. By this time Kent had dropped back to a normal typhoon. On the 16th, the tropical western North Pacific west of 150°E was under the influence of Tropical Storms Mark and Lois along with Typhoon Kent— a real menagé a trois. Platform 21004 (29°N, 135°E) measured 50-kn west southwesterlies in 15-ft seas at 0300 on the 17th under the influence of Kent. At 0000 on the 16th, the ***ELNV8*** hit 40-kn winds in 13-ft seas near the center of Tropical Storm Mark. In more northerly latitudes a storm was coming to life near 49°N, 165°E. This system moved along the Aleutians with a central pressure of about 990 mb for several days. At 0900 on the 17th, the ***3EPB6*** (46°N, 169°E) hit 40-kn westerlies in 17-ft swells. Ship reports on the 17th through the 19th indicated winds were blowing at 40 to 50 kn in 10- to 15-ft swells. Typical was the report from the ***Pacific Aries*** (44°N, 158°W) at 0600 on the 19th which reported measured 53-kn southeasterlies in 13-ft swells. Late on the 19th, the storm swung northward and turned a counterclockwise loop over a period of several days in the central Bering Sea. By the 22d the central pressure had dropped to 986 mb. The following day the system skimmed the Alaska Peninsula and moved and moved over the mainland on the 24th. On the 21st the ***Sea-Land Tacoma*** (52°N, 133°W) measured 42-kn winds in

Anglers Survive Hurricane Darby

Hal Neibling

*Last summer, five fishermen spent a harrowing 30 hours battling Hurricane Darby off the coast of Mexico before they were rescued by a banana boat enroute to Port Hueneme, California. This is a condensed version of the original article which appeared in **The International Angler**, the bulletin of the International Game Fish Association, 1301 East Atlantic Boulevard, Pompano Beach, FL 33060.*

On Wednesday, July 1, four friends and I headed for the Las Hadas resort and marina at Manzanillo, Mexico to meet the ***Oasis***, a new 65–foot Donzi sportfisherman equipped with all the latest toys.

That afternoon, we filled fuel bladders with an extra 300 gallons of diesel and checked the weather forecast twice. The only report was a "mild depression" below Acapulco, which was not expected to build fast nor move at any great amount of speed.

We left Las Hadas for Socorro Island, 378 nautical miles out to sea, and by dawn we had fishing lines in the water. Throughout that flat, calm, beautiful day, we hooked blue marlin and sailfish.

By Friday, we had checked in with a Mexican navy ship which had strung four cables out to the rocks and a fore–and–aft anchor. It appeared that they were preparing to ride out a hurricane, but we found out they had no knowledge of bad weather approaching. We continued to make daily calls to obtain the best weather reports available.

It was still calm, so we decided to move up to San Benedicto Island. Upon arrival, we hooked up immediately and we were quickly surrounded by sharks. That evening we anchored on the south end of the island behind the lava flow.

On Sunday morning, we awakened to 20–knot wind and waves. We pulled anchor and went to the lee side of San Benedicto. We soon realized that the wind had changed into a gale and so we tried to continue north towards Cabo San Lucas while the seas and winds continued to increase by the minute. We called for a weather update. The reports were 6 hours old, but we were told that a hurricane was heading towards us. It was moving faster than normal, travelling 19–20 miles per hour. The eye had passed below Socorro with sustained winds of 90–100 knots. The immediate size of the seas convinced us to turn back to Benedicto to try to find a lee. As the seas increased to 20 feet and winds reached 85–90 knots, our ground speed was slowed.

Somehow we reached the island intact, and we tried to save the eisenglass by rolling it up. Benedicto's lee was not approachable as the waves, currents, and winds "venturied" around the island. For the next 30 hours, we had to wear swimming masks because large amounts of pumice blew off the volcano and filled our teeth and noses with grit.

The size of the waves increased as we tried to seek better shelter. South of the island, waves and currents were slapping each other and jumping to 25–30 feet combers. We turned around again and a large wave erupted over the bow, swept over the flying bridge deck and blasted off the port jet ski and the whaler.

Tons of wild water shorted out the electronics on the bridge, and we lost both throttle control and headway on the boat. The starboard engine went out. Radio electronics were lost, except for the small radar and signet G.P.S.A. Fire short–circuited most of the remaining equipment.

We were able to maintain slow control enough to try to surf at angles to keep from breaking and rolling over. The still growing waves crashed into the cockpit and floated much of our gear out to sea. Anyone washed overboard would have been lost, so we tried to keep lifelines tied to everyone. Life preservers had been the order since the beginning.

After many devastating waves crashed into the stern cockpit, we knew we had to get the bow into the wind and waves. A Mayday was called. We struggled to rig and properly place the sea anchor which was only 6 feet in diameter with a 150–foot line, when we needed an 18–feet. with a 300–400 foot line.

Our bow was not being pulled into the weather and the ***Oasis*** was sitting crosswise to the swell. With each wave breaking into the boat, we were rolling dangerously close to a "turtle" position. We had to cut the sea anchor. Meanwhile, our skipper had gotten a hot wire going and re–started the starboard engine and throttle control power in forward only. The waves at this point were 25–40 feet with sustained winds of 90–100 gusting to 110 knots. We had yet another setback when the starboard engine went out again shortly after dark.

We were making somewhere between ½ and 1½ knots into the weather and every few minutes we tried to signal the Mexican Navy, Coast Guard, or anyone out

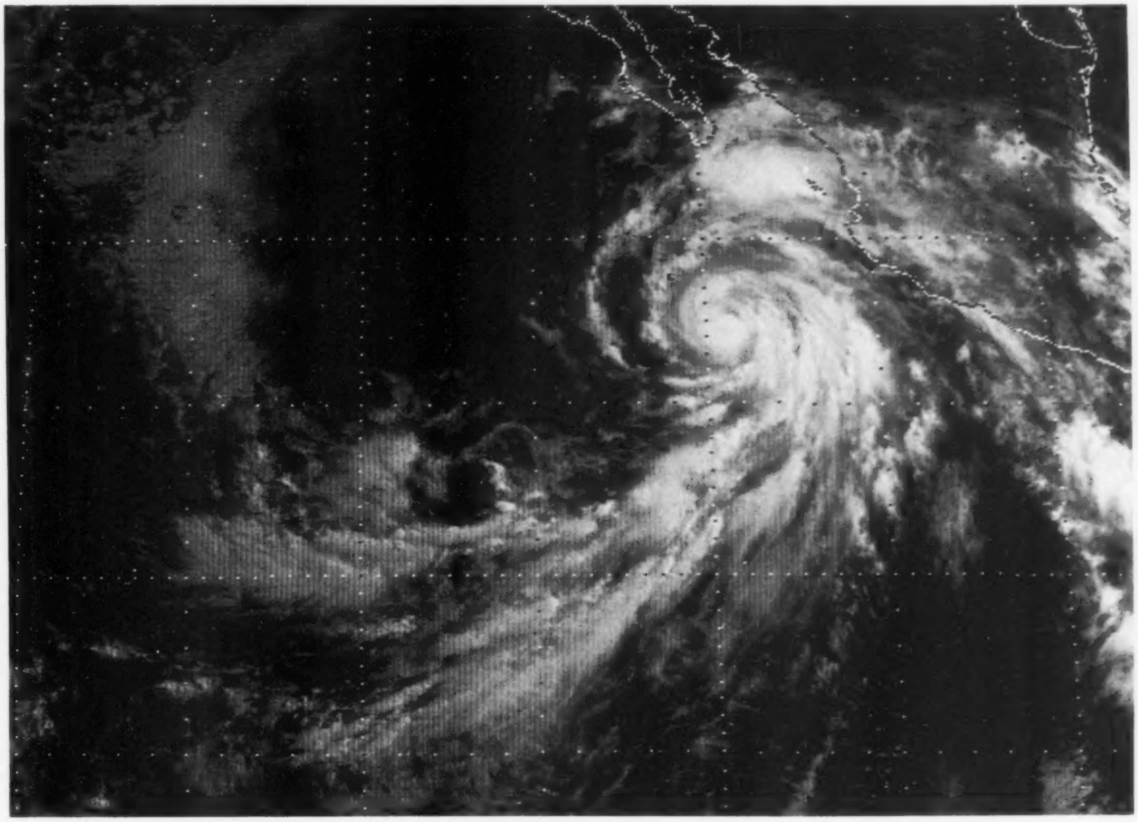
there on the only VHF radio we had. Around 11 p.m. a rogue wave built up and crashed through our two starboard salon windows, splintering the safety glass. The wave threw three men down into the wall and left one crewmember with a severely lacerated arm.

The wave sent waist–high water swirling and short–circuited the electronic panels. We could feel a current of electricity move up our legs. Lights sparked and popped. The water blew out the salon door and raced down the steps into the engine room below. The captain worked frantically to rewire bilge pumps while the starboard side air vents blew out. We were left with throttle power on the port engine.

We called Mayday and finally a Coast Guard plane raised 50 miles away told us that a ship had been dispatched from Cabo San Lucas 220 miles away. The ***Chiquita Roma*** was due around 9 a.m. the next morning. Soon, the plane's lights became visible which restored a lot of faith to seven weary men who were exhausted, hungry, and running on nerves for near 30 hours.

The C–130 circled until 3 a.m. and then left. By now we only had a small hand–held ICOM VHF.

When the ***Chiquita Roma*** found us, the captain was worried about the jagged rocks close to shore so we had to make our way back into the huge seas. On second pass, we got a fore and aft line on the boat which slowed its forward motion. Once on board, we all watched the battered ***Oasis*** drift away with the engine room steadily filling. The ***Chiquita Roma's*** Captain Rick Bautista and his crew could not have done more to make us comfortable. We were grateful to be alive and to get back home to our families.



Satellite Data Services Division

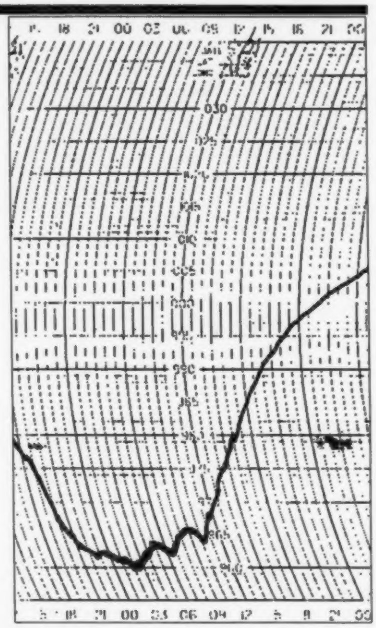
Hurricane Darby

17–ft seas while on the 24th the ***Alligator Joy*** (53°N, 165°W) hit 40–kn winds in 20–ft swells.

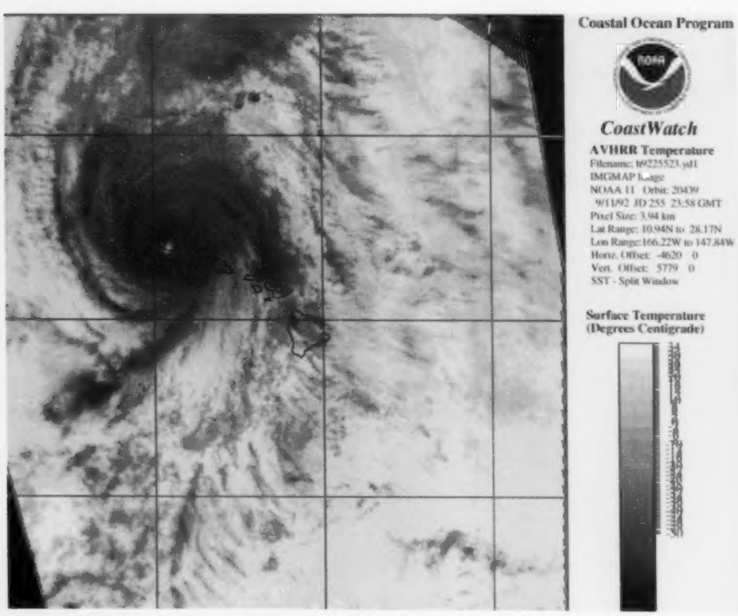
Before the month was out, another system came to life over the Bering Sea. It formed west of Kamchatka on the 23rd and headed eastward. Moving through the Bering Sea as a 992–mb Low, it generated winds to near gale force between the 24th and 25th. To the south Tropical Storm Polly and Typhoon Omar had come to life in the west, while the eastern North Pacific had spawned Tropical Storms Madeline and Newton. Before the month was out Omar was a super typhoon and bearing down on Guam.

Casualties—During Typhoon Janis bulk carrier ***Ocean Pearl*** grounded in Kagoshima Bay on the 8th while seeking shelter. There was no oil spill or crew injury reported. The refrigerator vessel ***San Fatt*** was driven aground at Kobe on the 8th. Janis was blamed for two deaths and 41 injuries in Japan. In heavy seas at dockside the ***Pices Planter*** was holed and dented on the 17th at Hong Kong. Typhoon Kent blasted southern Japan with gales and huge waves resulting in at least five deaths. During a day at the beach, rough surf swept a family of six out to sea and only one survived, while two were listed as missing.

Omar ravaged Guam around midnight on the 28th when winds reached 110 kn to 130 kn. Despite the fact that several northern towns were flattened, there were no deaths reported although 59 people were injured. Officials said it was the worst storm to hit Guam since 1976 when Typhoon Pamela flattened most of the houses on the island. In addition during Omar, the USS ***White Plains*** and USS ***Niagara Falls*** broke their moorings and were driven aground.



Most of the island was left without food, electricity, and water. The Military Sealift Command assisted by bringing in generators, cranes, bulldozers, water tanks, and purification equipment, which were unloaded by 86 U.S. Marines. At least 5,000 homes were damaged or destroyed. Omar wasn't finished. After leaving Guam, it hit Taiwan leaving one person dead and four injured. Three vessels were driven aground in the port of Kaohsuing, while an Indian–registered cargo vessel with a crew of 40 was missing off southern Taiwan after sending distress signals. On the 29th the barge ***Saint Cecilia*** sank off Carnaza Is, while the motor vessel ***Thai Yung*** was driven aground in the vicinity of Bangui Bay, off the northern tip of Luzon, on the 30th. During Typhoon Polly, Taiwan reported eight deaths.



CoastWatch

Hurricane Iniki with its center over Kauai was one of the most devastating storms to ever hit the Hawaiian Islands. Photograph was provided by CoastWatch. Above, right ***The Glacier Bay*** *runs into a little problem on the 28th of September near 56°N, 140°W.*

September— A flurry of extratropical activity on the Gulf of Alaska resulted in the Aleutian Low being centered in these waters—

a departure from its normal location on the western side of the Alaska Peninsula. The subtropical high was close to normal although a 4–mb negative pressure anomaly southeast of Japan hinted at possible heavier–than–normal tropical cyclone activity in those waters. This was supported by the facts—Typhoons Ryan, Sibyl, and Ward along with Tropical Storm Val contributed to this deficit. The big tropical cyclone news of the month, however, was Hurricane Iniki in the central North Pacific, which devastated the island of Kauai in the Hawaiian Islands. In addition, Hurricanes Roslyn, Orlene, Seymor, and Tina along with Tropical Storm Paine came to life in the eastern North Pacific.

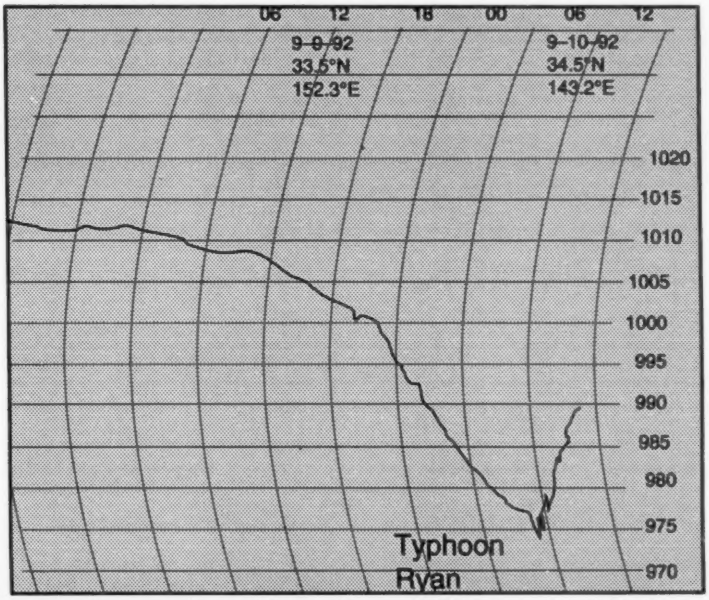
The weather spotlight for the first half of the month definitely fell on the tropics. In the western North Pacific, Ryan and Sibyl both came to life during the first week as did Orlene and Iniki east of the dateline. Complete summaries for these tropical cyclones will be found in future issues of the *Mariners Weather Log*. However, Sibyl after undergoing an extratropical transformation on the 14th remained a potent storm for the following week. On the 16th its pressure was estimated at 964 mb near 42°N, 166°E. The ***Nippon Reefer*** ran into 40–kn winds on the 16th and 17th while sailing on the south side of the storm center. At 1200 on the 19th, the ***Star Drottanger*** (53°N, 175°W) ran into 40–kn easterlies in 17–ft swells. The storm was weakening by this time but remained organized until it moved ashore on the 23rd along the coast of British Columbia.

Around the same time, a Low was developing over the northern part of Sakhalin Is. It followed a zonal route across the Bering Sea and by the 25th its central pressure was down to 979 mb. The following day it moved into the Gulf of Alaska after crossing through the Aleutians. Ships along the northern routes were reporting winds in the 40–kn range with seas in the 10– to 15–ft range. On the 28th and 29th, the system deepened further. Before it went ashore its central pressure dipped to 964 mb. At 0600 on the 29th, the ***Great Land*** 57°N, 142°W) encountered 43–kn northerlies and measured a 973–mb pressure. The ***Sea–Land Tacoma*** (50°N, 129°W) measured a 42–kn southeasterly in 24–ft swells at 1200 that same day. Weather was rough in the Gulf of Alaska.

Tropical Storm Val found life after tropical activity when it turned extratropical on the 27th near 35°N, 150°E. Moving north northeastward it intensified to a 977–mb Low on the 28th and then pressure dipped to 969 mb by the 29th. Ships within the circulation were encountering 40– to 45–kn winds and 15– to 20–ft seas. The storm began to fade on the last day of the month as it made its way across the Bering Sea.

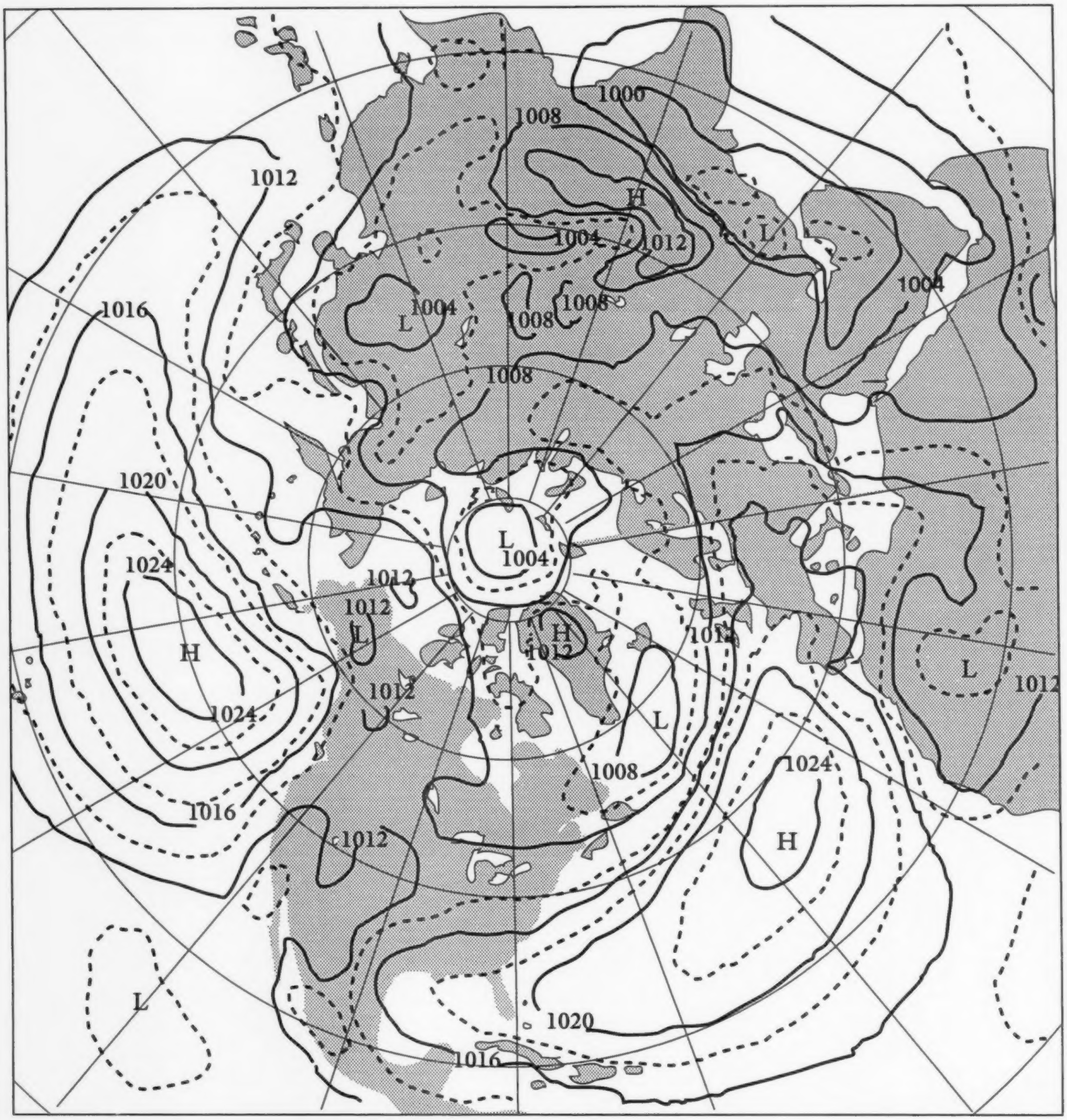
Casualties— On the 11th Hurricane Iniki lashed Kauai with sustained winds of 110 kn with gusts to 140 kn, causing major widespread damage to the island. On an island of some 53, 000 permanent residents, it was estimated that 7, 000 were left homeless. Preliminary damage estimates are well over $2 billion. During the storm the 70–ft fishing vessel ***Shookum Half Moon Bay*** capsized and sank and one of its three crew members drowned. On Hawaii the vessel ***Hookele*** broke loose and grounded in Keauhou Bay.

During Typhoon Ted's trek across the northern Philippines, torrential rains triggered mudslides and two children were killed. In China mudslides were responsible for 19 deaths with more than 100 others missing.



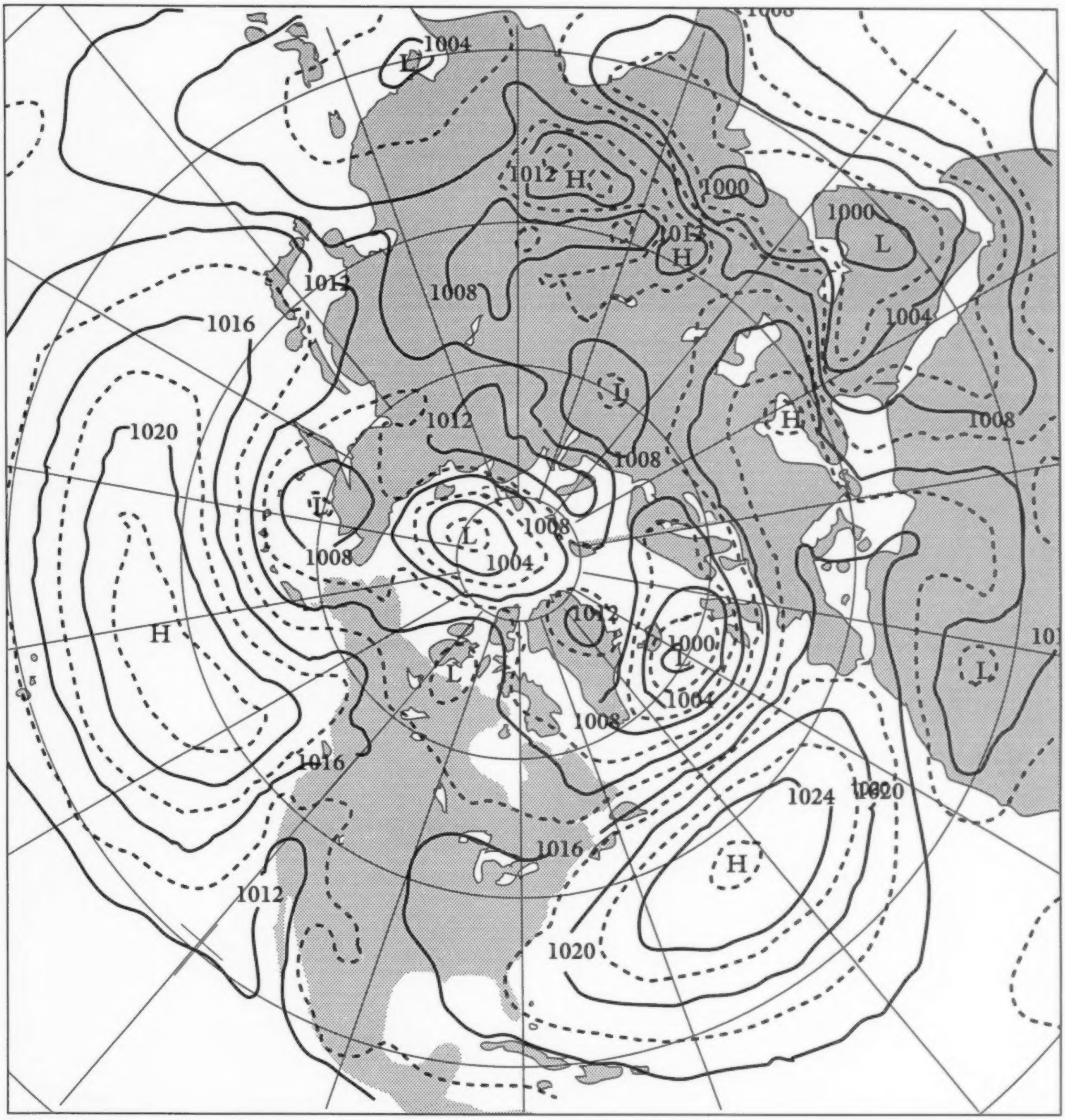
Sea–Land Consumer encountered Typhoon Ryan on the 9th and recorded a 973–mb pressure. At 0900 on the 10th, they reported 50–kn winds near 35°N, 144°E.

July 1992



These Charts were Provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin.

August 1992



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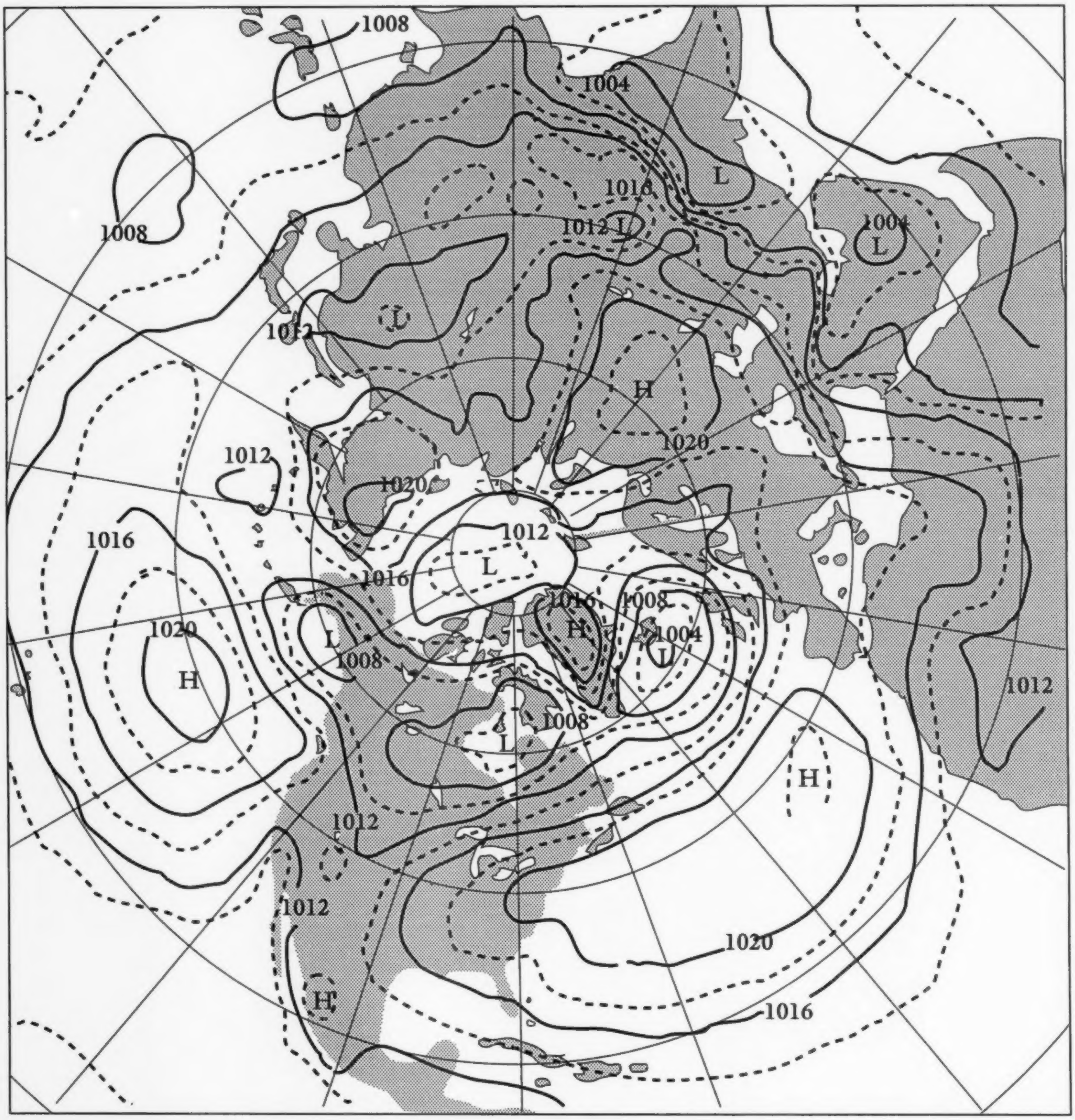
September 1992



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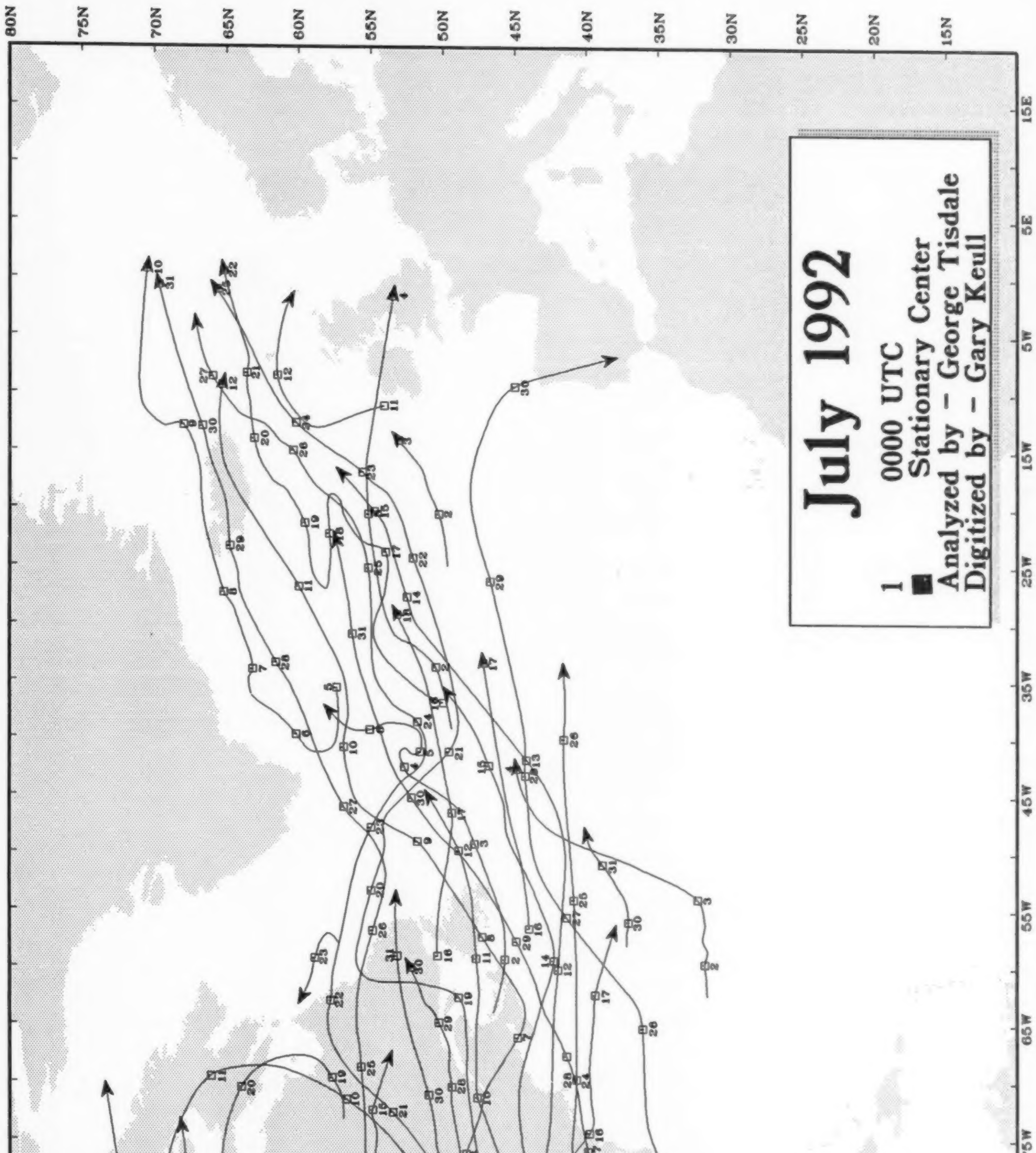
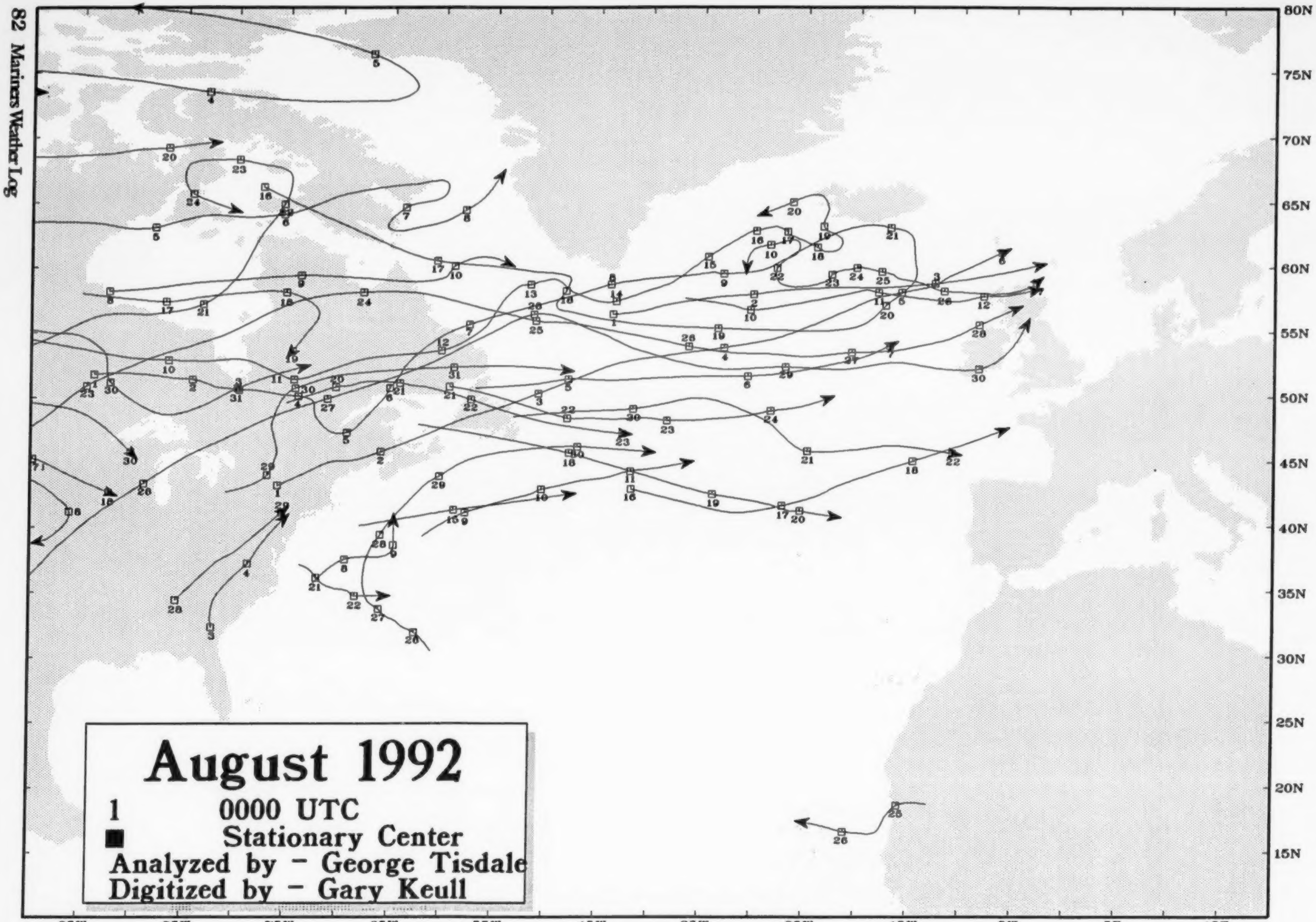
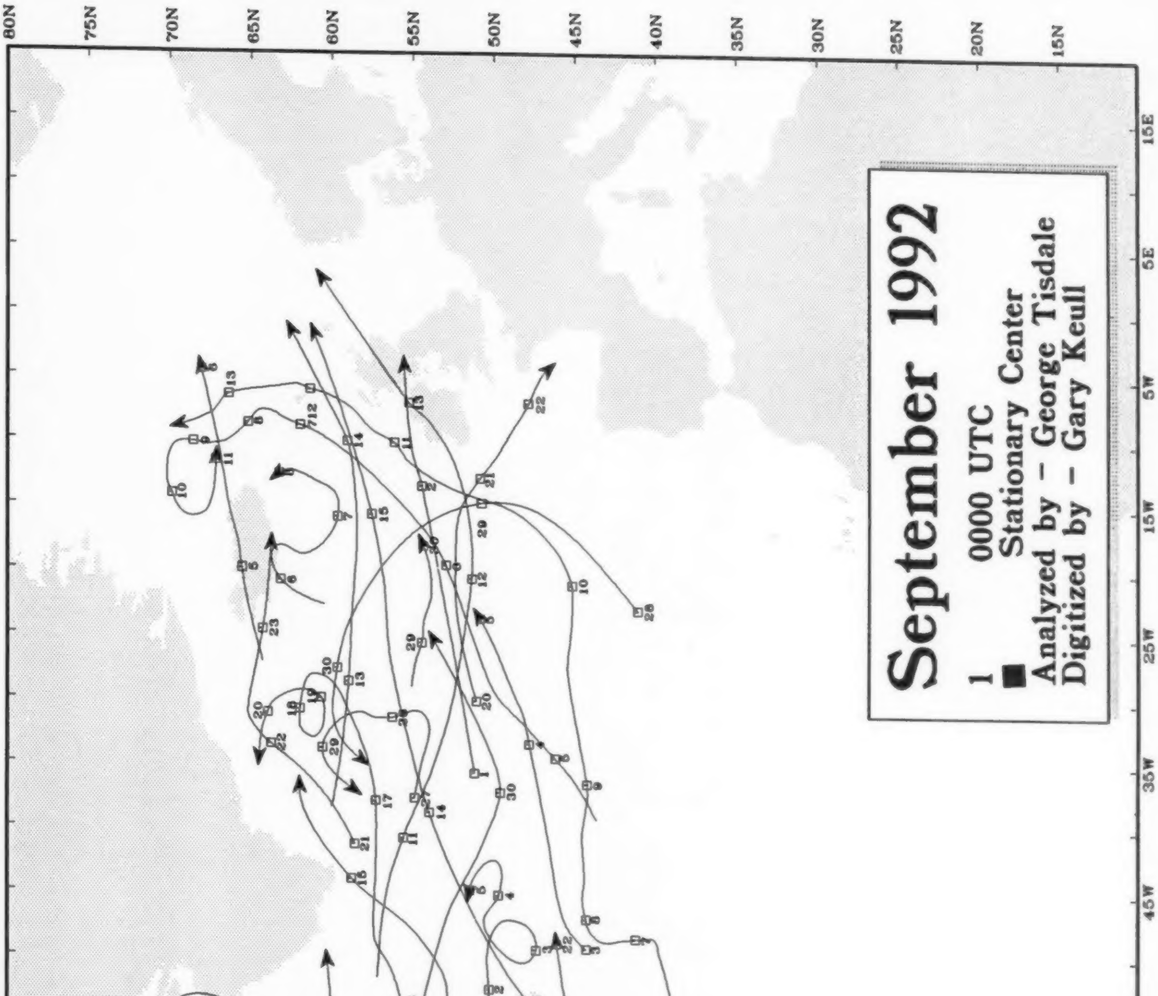
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



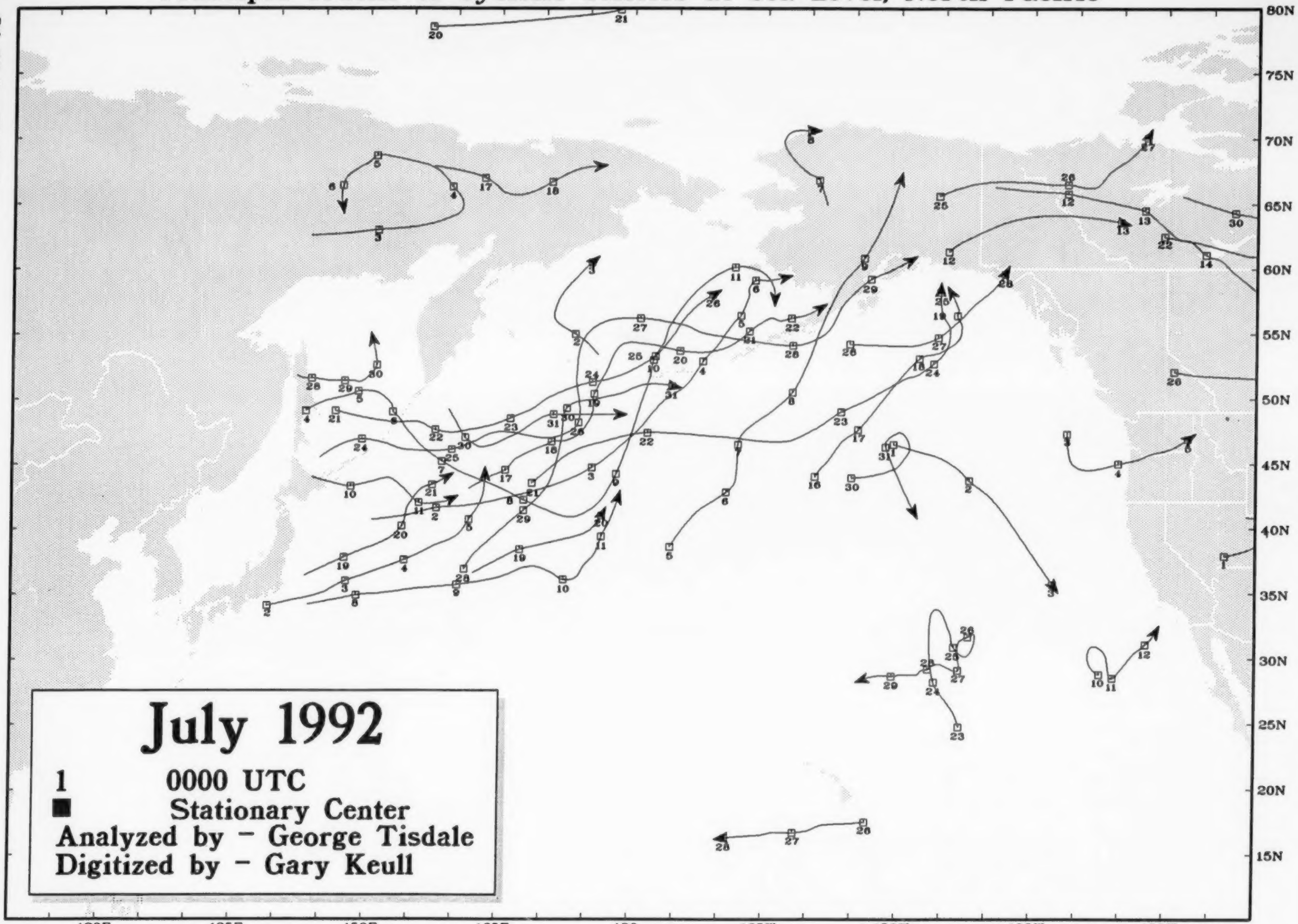
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



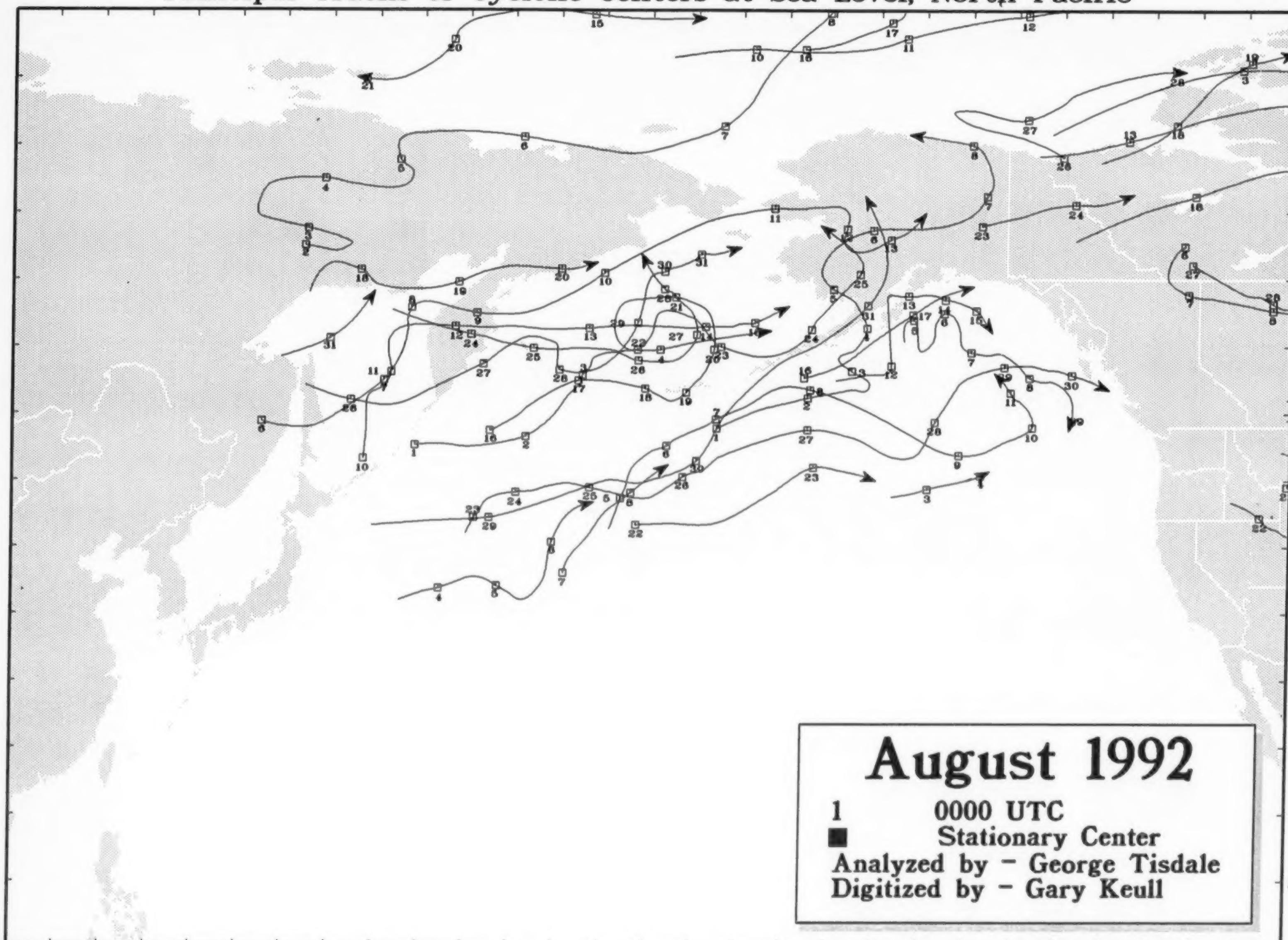
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic



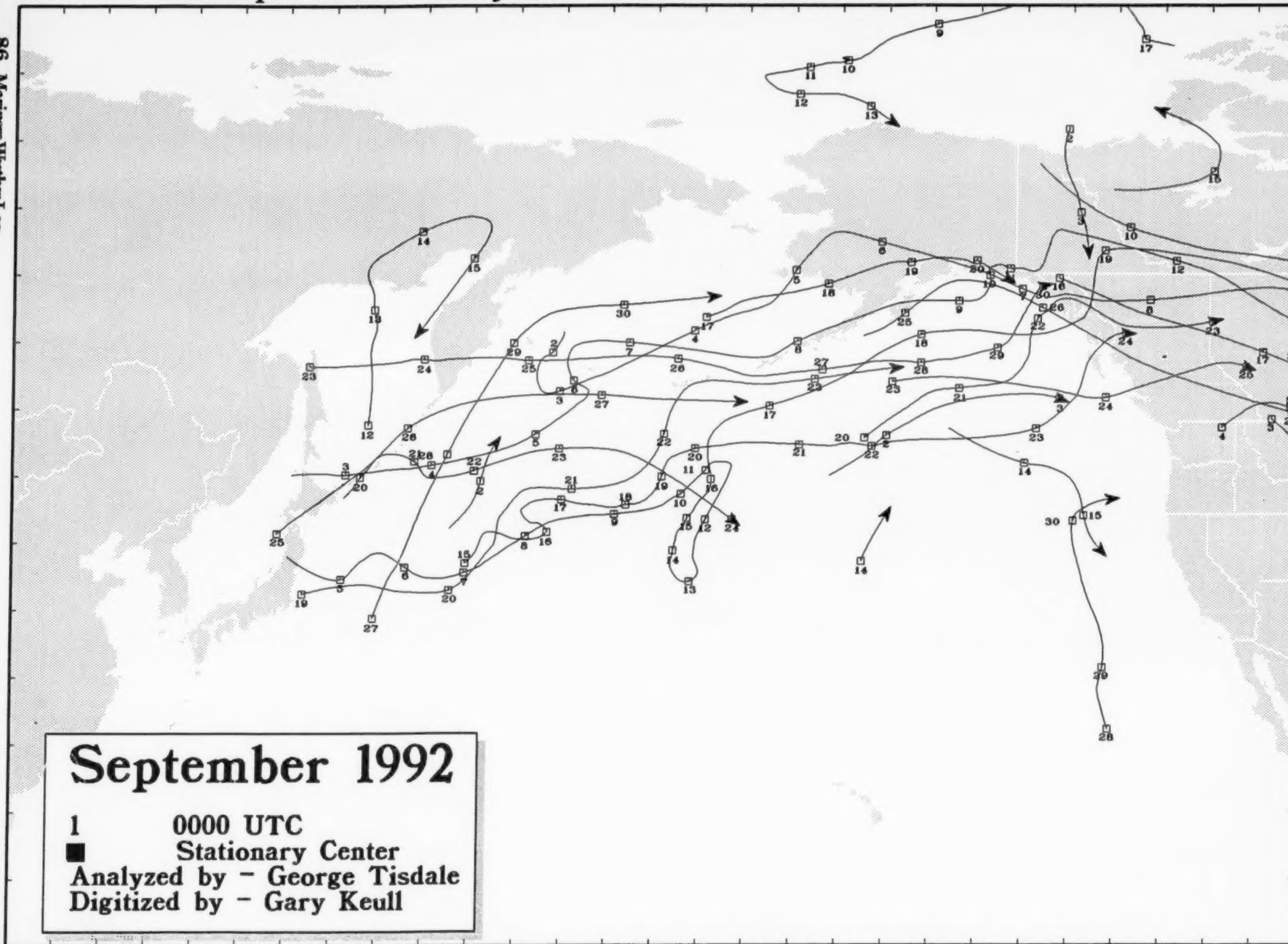
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



Principal Tracks of Cyclone Centers at Sea Level, North Pacific



July, August, and September 1992

	RADIO	MAIL
1ST LT ALEX BONNYMAN	50	97
1ST LT BALDOMERO LOPEZ	43	20
A. V. KASTNER	149	
ACE ACCORD	31	17
ACONCAGUA	20	
ACT 11	66	
ACT 5	130	
ACT 7	245	
ACT I	110	
ADABELLE LYKES	45	34
ADDIRIYAH	19	
ADMIRALTY BAY	19	
ADRIAN MAERSK	9	55
AINO	104	
ALASKA RAINBOW	56	91
ALBERT MAERSK	13	15
ALDEN W. CLAUSEN	40	209
ALLIGATOR COLUMBUS	47	34
ALLIGATOR EXCELLENCE	60	
ALLIGATOR FORTUNE	28	
ALLIGATOR GLORY	46	
ALLIGATOR HOPE	60	61
ALLIGATOR JOY	73	
ALLIGATOR LIBERTY	51	
ALLIGATOR PRIDE	37	31
ALLIGATOR TRIUMPH	51	15
ALMERIA LYKES	49	62
ALPENA	181	212
ALTAMONTE	36	38
AMBASSADOR		13
AMER HIMALAYA	29	
AMERICA EXPRESS	189	
AMERICA STAR	165	
AMERICAN CONDOR	2	82
AMERICAN EAGLE	37	
AMERICAN FALCON	102	172
AMERICAN HERITAGE	4	
AMERICAN KESTREL	41	32
AMERICAN MARINER	23	35
AMERICAN REPUBLIC	95	130
AMERICAN VETERAN	11	
AMERICANA	59	74
AMERIGO VESPUCCI	7	18
ANIKA, GERMANY	5	70
ARABIAN SENATOR	108	
ARCO ALASKA	7	27
ARCO ANCHORAGE	11	8
ARCO CALIFORNIA	18	40
ARCO FAIRBANKS	26	28
ARCO INDEPENDENCE	23	
ARCO JUNEAU	23	
ARCO SAG RIVER	17	
ARCO SPIRIT	35	30
ARCO TEXAS	36	35
ARCTIC OCEAN	33	81
ARCTIC TOKYO	42	156
ARGONAUT	36	121
ARIES	9	
ARILD MAERSK	23	66
ARMCO	112	131
ARNOLD MAERSK	14	
ARTHUR M. ANDERSON	158	167
ARTHUR MAERSK	33	92
ASHLEY LYKES	28	52
ASIAN SENATOR	153	
ASPEN	13	37
ASTRO JYOJIN	44	47
ATIGUN PASS	2	16
ATLANTA BAY	66	
ATLANTIC CARTIER	91	
ATLANTIC COMPASS	92	
ATLANTIC CONVEYOR	103	
ATLANTIC OCEAN	103	120
ATLANTIS II	11	9
ATLAS HIGHWAY	21	
AUSTRAL RAINBOW	27	33
AXEL MAERSK	35	122
AYA II	180	
B.T. ALASKA	80	98
BACTAZAR	23	56
BADGER, USA	9	51

	RADIO	MAIL
BAHIS MAGDALENA, PANAMA	41	102
BAKRI VOYAGER	1	
BALTIMORE TRADER	35	97
BAY BRIDGE	119	149
BEBEDOURO	18	
BIBI	119	
BLUE HAWK	15	
BOGASARI LIMA	193	
BONN EXPRESS	51	
BRIGIT MAERSK	18	78
BROOKLYN BRIDGE	108	141
BROOKS RANGE	12	
BUCKEYE	110	138
BUFFALO	2	
BUNGA KANTAN	1	
BUNGA KENANGA	2	
BURNS HARBOR	459	491
BUYER	22	
C.W. KITTO		14
CALCITE II	154	164
CALIFORNIA CERES	50	
CALIFORNIA GALAXY	106	
CALIFORNIA HERMES	44	
CALIFORNIA ORION	91	96
CALIFORNIA STAR	176	
CALIFORNIA TRITON	136	50
CANADIAN RAINBOW	39	79
CAPE DOUGLAS, USA		7
CAPE HUDSON	65	101
CAPE MAY	71	
CARIBE 1	5	15
CARINA, PANAMA	36	58
CARLA A. HILLS	38	119
CARMEL	14	52
CARNIVALE, BAHAMAS	12	12
CAROLINA	6	68
CARTAGENA	153	91
CASON J. CALLAWAY	210	157
CAVALLINO, PANAMA	28	56
CELEBRATION	30	31
CENTURY HIGHWAY NO. 5	150	
CENTURY HIGHWAY NO.2 P	143	86
CGM ILE DE FRANCE	150	89
CGM LORRAINE	48	
CGM PROVENCE	81	
CHABLIS	12	
CHAITEN	41	
CHARLES E. WILSON	181	215
CHARLES M. BEEGHLEY	95	85
CHARLES PIGOTT		65
CHARLESTON	50	27
CHARLOTTE LYKES	36	65
CHEMICAL PIONEER	92	96
CHERRY VALLEY	39	38
CHESAPEAKE TRADER	76	86
CHESNUT HILL	43	92
CHEVRON BURNABY	133	139
CHEVRON CALIFORNIA	171	120
CHEVRON COLORADO	19	76
CHEVRON EDINBURGH	117	238
CHEVRON FELUY		102
CHEVRON HORIZON		109
CHEVRON LOUISIANA		9
CHEVRON METEOR	29	70
CHEVRON MISSISSIPPI	73	82
CHEVRON OREGON	7	12
CHEVRON PACIFIC	37	217
CHEVRON SKY		50
CHEVRON STAR		126
CHEVRON SUN	3	164
CHEVRON WASHINGTON	80	102
CHICKASAW	65	175
CHINA PRIDE	12	
CHIQUITA BOCAS	3	
CHIQUITA CINCINNATION	97	8
CHIQUITA ROMA, BAHAMAS		46
CHO YANG SUCCESS	4	
CHOAPA	1	
CLEMENTINA	60	
CLEVELAND	30	52
CO-OP EXPRESS III	35	

	RADIO	MAIL
COAST RANGE	6	19
COASTAL EAGLE POINT	2	
COASTAL MANATEE	16	
COLIMA	1	46
COLUMBIA STAR	135	107
COLUMBINE	23	28
COLUMBUS AMERICA	347	
COLUMBUS AUSTRALIA	142	
COLUMBUS LOUISANA	15	
COLUMBUS NEW ZEALAND	110	
COLUMBUS OHIO	42	13
COLUMBUS OLIVOS	48	142
COLUMBUS QUEENSLAND	126	
COLUMBUS VICTORIA	173	
COLUMBUS VIRGINIA	172	
COLUMBUS WELLINGTON	183	
COMPANION EXPRESS	88	
CONCERT EXPRESS	84	
CONSENSUS SEA	11	
CONTIENTAL WING	77	
CORAH ANN	105	123
CORNHUSKER STATE		12
CORNUCOPIA	5	53
CORONADO	36	54
CORWITH CRAMER	5	20
COURIER	46	23
COURTNEY BURTON	118	111
CPL. LOUIS J. HAUGE JR	43	31
CRISTOFORO COLOMBO	18	71
CSS HUDSON	88	
DAMIOS DE GOIS	13	
DAN MOORE	13	
DELAWARE TRADER	28	50
DEPPE AMERICA	8	
DIANA	10	45
DILIGENCE TRADER	1	
DIRECT FALCON	11	
DIRECT KIWI	77	125
DIRECT KOOKABURRA	62	134
DOCTOR LYKES, PANAMA	33	57
DON JORGE	27	
DONAIRE		271
DSR OAKLAND	19	
DSR YOKOHAMA	54	
DUSSELDORF EXPRESS	96	
DYVI OCEANIC	20	
EASTERN GLORY	3	
ECSTASY	138	63
EDGAR B. SPEER	283	298
EDWARD L. RYERSON	203	214
EDWIN H. GOTT	434	462
EDYTH L.	37	
ELIZABETH LYKES	36	23
ENDEAVOR	21	57
ESPERANCE	35	
ESPERANZA	6	
ESSO PUERTO RICO	46	
ETERNITY	32	
EUROPEAN SENATOR	69	
EVER GAINING	8	
EVER GARDEN	6	10
EVER GATHER	5	
EVER GENTLE	9	
EVER GIANT	12	
EVER GIVEN	2	
EVER GLAMOUR	5	11
EVER GLOBE, PANAMA	18	21
EVER GOING	1	
EVER GRADE	24	12
EVER GRAND	6	
EVER GROUP	3	
EVER GROWTH	4	
EVER GUARD	12	
EVER GUEST	3	
EVER LAUREL	26	
EVER LEVEL	3	
EVER LIVING	3	
EXPORT FREEDOM	46	117
EXPORT PATRIOT	50	108
EXXON BATON ROUGE	38	47
EXXON BENICIA	32	11

	RADIO	MAIL
EXXON CHARLESTON	7	
EXXON LONG BEACH		2
EXXON MEDITERRANEAN	8	4
EXXON NEW ORLEANS	20	15
EXXON PHILADELPHIA	25	29
EXXON SAN FRANCISCO	28	39
FARNELLA	46	
FAUST	51	81
FERNCROFT	73	88
FESTIVALE	26	18
FETISH	139	190
FLEMMING SIF	60	77
FLORIDA RAINBOW	4	
FRANCES HAMMER	146	203
FRANCES L.	65	104
FRED R. WHITE JR	12	15
FREDRICK LYKES,CYPRUS	51	66
GALVESTON BAY	82	112
GEMINI	25	122
GENEVIEVE LYKES	22	
GEORGE A. SLOAN	88	54
GEORGE A. STINSON	80	94
GEORGE H. WEYERHAEUSER	19	94
GEORGE WASHINGTON BRID	192	50
GEORGIA RAINBOW II	38	52
GERMAN SENATOR	54	
GERONIMO	10	
GLACIER BAY	21	41
GLOBAL SENTENIAL	51	
GLORIOUS SPICA	28	
GOLDEN GATE	2	1
GOLDEN GATE BRIDGE	184	59
GOLDEN TOPAZ	33	
GREAT LAND	11	335
GREAT RIVER	23	
GREEN BAY	52	104
GREEN HARBOUR	58	127
GREEN ISLAND	33	30
GREEN KOBE	16	119
GREEN LAKE	91	190
GREEN RIDGE	2	
GREEN SAIKAI	9	65
GREEN SASEBO	48	188
GREEN SUMA	24	
GREEN VALLEY	50	66
GREEN WAVE	66	64
GTS ADMIRAL WILLIAM MC	5	6
GUANAJUATO	144	154
GUAYAMA	14	50
GULF SPEED	57	
GULF SPIRIT	96	
GYPSUM BARON	186	
GYPSUM KING	198	
GYRE	13	
HANEI SKY	15	83
HANJIN CHUNGMU	31	
HANJIN FELIXSTOWE	16	
HANJIN HAMBURG	11	8
HANJIN HONG KONG	7	
HANJIN KAOHSIUNG	14	
HANJIN KEELUNG	17	
HANJIN KOBE	33	
HANJIN KUNSAN	11	
HANJIN LE HAVRE	11	
HANJIN LONG BEACH	17	
HANJIN MASAN	38	
HANJIN NEW YORK	28	
HANJIN OAKLAND	8	
HANJIN POHANG	30	
HANJIN ROTTERDAM	15	
HANJIN SAVANNAH	34	
HANJIN SEATTLE	17	
HANJIN SEOUL	23	29
HANJIN TONGHAE	35	
HANJIN VANCOUVER	10	
HANJIN YOKOHAMA	35	
HANNOVERLAND	89	
HANSA LUBECK	74	
HANSA VISBY	96	
HEIDELBERG EXPRESS	56	
HENRY HUDSON BRIDGE	185	
HERMENIA	59	90
HESIOD	18	
HIRA II	23	
HOEGH CLIPPER	26	14
HOEGH DRAKE	19	14
HOEGH DUKE	7	

	RADIO	MAIL
HOEGH DYKE	39	57
HOEGH MIRANDA	8	
HOLCK LARSEN,INDIA	28	
HOLIDAY	42	
HORNSTREAM	42	
HOWELL LYKES	33	64
HUAL LISITA		33
HUAL TRAPPER,PANAMA	10	14
HUMACAO	17	
HUMBER ARM	9	
HYUNDAI CHALLENGER	23	
HYUNDAI COMMANDER	28	
HYUNDAI CONTINENTAL	49	
HYUNDAI EXPLORER	4	
HYUNDAI NO 102	16	
HYUNDAI PIONEER	26	
INDEPENDENT SPIRIT	153	
INDIAN OCEAN	52	69
INFANTA	153	
INGER	17	
ISLAND PRINCESS	71	
ITB BALTIMORE	51	93
ITB NEW YORK	104	115
ITB PHILADELPHIA	76	133
IVER EXPLORER	49	
IVER EXPRESS	33	
J.DENNIS BONNEY,MONRAV	2	211
J.L. MAUTHE	42	69
JACKSONVILLE	84	131
JALISCO	51	36
JAMES LYKES	56	132
JAMES R. BARKER	236	248
JAPAN RAINBOW 2	57	36
JAPAN SENATOR	102	
JO BIRK	89	
JO BRIED	18	15
JO ROGN	26	
JOHN G. MUNSON	337	378
JOHN J BOLAND,USA	177	222
JOHN LYKES	24	
JOHN V. VICKERS	110	23
JOHN YOUNG		126
JOSEPH H. FRANTZ	269	297
JOSEPH L. BLOCK	128	109
JUBILEE	7	
JULIUS HAMMER	86	78
KAIMOKU	75	109
KAINULA	43	198
KAUAI	75	164
KAYE E. BARKER	127	107
KEBAN		43
KEE LUNG	12	39
KEISHO MARU	55	
KENAI	26	91
KENNETH E. HILL	47	131
KENNETH T. DERR	73	118
KENTUCKY HIGHWAY	4	
KEYSTONE CANYON	69	41
KEYSTONE STATE	2	
KEYSTONER	58	139
KINSMAN ENTERPRISE,USA	17	31
KITTANING	6	36
KOKUA	95	73
KOLN ATLANTIC	119	
KOPER EXPRESS	12	
KRAS	61	53
KUROBE	31	40
LAKE GUARDIAN	41	37
LASH ATLANTICO	26	9
LAUST MAERSK	44	113
LEONARD J. COWLEY	21	
LERMA	55	
LETITIA LYKES	65	
LIBERTY SPIRIT	38	69
LIBERTY STAR	36	40
LIBERTY SUN	59	23
LIBERTY WAVE	35	47
LIRCAY	42	
LNG AQUARIUS	21	
LNG CAPRICORN	12	17
LNG LEO	53	84
LNG LIBRA	2	
LNG TAURUS	15	164
LNG VIRGO	13	77
LONG LINES	33	5
LUNA MAERSK,DENMARK	51	100
LURLINE	53	172
LYRA	26	

	RADIO	MAIL
M.V. BOB L,PANAMA		20
M.V. CHIQUITA MILANO,B	22	50
M.V. PATRICIA RICKMERS	20	46
M.V.CARRIBEAN EMERALD,	23	130
M/S KAKUSHIMA,MONROVIA	51	38
M/S VIVA	60	49
M/T ELLEN KNUTSEN,NORW	42	75
M/V HUAL INGRITA,NORWA	14	18
MAASSLOT	102	
MAASSTROOM	163	
MACKINAC BRIDGE	189	50
MADISON MAERSK	26	90
MAERSK COMMANDER	113	
MAERSK CONSTELLATION	33	83
MAERSK SUN	68	81
MAGLEBY MAERSK	38	60
MAJ STEPHEN W PLESS MP	16	10
MAJESTIC MAERSK	18	34
MANHATTAN BRIDGE	160	
MANUKAI	38	167
MANULANI	42	189
MARATHA MAJESTY	63	
MARCHEN MAERSK	14	37
MAREN MAERSK	50	89
MARGARET LYKES	45	54
MARGRETHE MAERSK	30	99
MARIA TOPIC	4	
MARIE MAERSK	4	
MARIF	39	26
MARINE RELIANCE	41	
MARIT MAERSK	60	79
MARJORIE LYKES	28	74
MARLIN		240
MASON LYKES	61	104
MATHILDE MAERSK	28	63
MATSONIA	45	113
MAUI	139	71
MAURICE EWING	185	158
MAYAGUEZ	51	98
MAYVIEW MAERSK	23	57
MC-KINNEY MAERSK	42	102
MEDALLION	117	129
MEDUSA CHALLENGER	214	244
MELBOURNE STAR	86	
MELVILLE	49	127
MEONIA	177	
MERCANDIAN CONTINENT	41	33
MERCANDIAN SUN II	32	
MERCURY ACE	71	
MERIDA	51	21
MERKUR LAKE	84	
MERKUR PORTUGAL	521	
MESABI MINER	76	86
METTE MAERSK	19	104
MICHIGAN HIGHWAY	41	
MICHIGAN,USA	302	242
MICRONESIAN COMMERCE	29	9
MICRONESIAN INDEPENDEN	52	
MIDDLETOWN	72	101
MING GLORY,TAIWAN ROC	9	
MING OCEAN	12	
MING PEACE	42	
MING PLEASURE	18	
MING PLENTY	42	45
MING PROMOTION	11	
MITLA	125	121
MOANA PACIFIC	117	
MOANA WAVE	70	90
MOKU PAHU	118	218
MONTE CERVANTES	24	
MONTERREY	95	100
MORELOS	51	128
MORMACSKY	30	
MORMACSTAR	25	
MORMACSUN	48	84
MV BOLD,GERMANY		53
MV GEMINI,USA	40	73
MV R. J. PREIFFER,USA	22	41
MV/CHESAPEAKE CITY,USA	54	47
MV/SEA ISLE CITY,USA	79	76
MV/TORM FREYA,DENMARK	79	55
MYRON C. TAYLOR	147	169
NACIONAL SANTOS	2	
NACIONAL VITORIA	16	
NAPIER STAR	14	
NARA	8	
NATIONAL DIGNITY	19	62

	RADIO	MAIL
NATIONAL HONOR	12	15
NATIONAL PRIDE	26	15
NCC ARAR	18	25
NECHES	22	
NEDLLOYD HOLLAND	48	63
NEDLLOYD HONG KONG	114	
NEDLLOYD HUDSON	51	73
NEDLLOYD MADRAS	171	
NEDLLOYD MANILA	120	
NEDLLOYD ROTTERDAM	120	
NEDLLOYD ROUEN	146	
NEDLLOYD VAN CLOON	73	
NEDLLOYD VAN DIEMEN	40	
NEDLLOYD VAN NOORT	96	
NEPTUNE ACE	14	
NEPTUNE AGATE	12	
NEPTUNE AMBER	52	37
NEPTUNE CORAL	40	
NEPTUNE CRYSTAL	76	143
NEPTUNE DIAMOND	221	
NEPTUNE GARNET	41	
NEPTUNE JADE	39	
NEPTUNE PEARL	9	
NEW HORIZON	50	32
NEW YORK SENATOR	29	
NEWARK BAY	49	153
NIEUW AMSTERDAM	4	
NIPPON HIGHWAY	39	
NOAA DAVID STARR JORDA	264	207
NOAA SHIP ALBATROSS IV	248	213
NOAA SHIP CHAPMAN	243	251
NOAA SHIP DELAWARE II	394	405
NOAA SHIP DISCOVERER O	499	524
NOAA SHIP FERREL	44	65
NOAA SHIP M. BALDRIDGE	305	
NOAA SHIP MCARTHUR	416	455
NOAA SHIP MILLER FREEM	433	483
NOAA SHIP MT MITCHELL	183	205
NOAA SHIP OREGON II	284	441
NOAA SHIP RAINIER	237	63
NOAA SHIP T. CROMWELL	51	414
NOAA SHIP WHITING	227	365
NOBLE ACE	50	71
NOSAC EXPLORER	25	43
NOSAC EXPRESS	26	113
NOSAC RANGER	56	104
NOSAC STAR,NORWAY	13	
NOSAC TAI SHAN	1	26
NOSAC TAKAYAMA	73	15
NUEVO SAN JUAN	60	120
NURNBERG ATLANTIC	78	
NYK STARLIGHT	57	
OAXACA	156	104
OBO ENGIN	32	
OCEAN ASPIRATION	65	115
OCEAN CHEER	66	
OCEAN CONQUEROR	6	182
OCEAN HIGHWAY	18	
OCEAN ISLAND	22	
OCEAN LILY	23	
OCEAN SEL		44
OCEAN SPIRIT	62	
OCEAN VICTOR	2	36
OLEANDER	84	86
OLGA TOPIC	19	
OLIVE ACE	64	
OMI CHAMPION	17	
OMI CHARGER	38	35
OMI MISSOURI	74	68
OMI WABASH	106	86
OOCL EDUCATOR	48	27
OOCL ENVOY	64	75
OOCL EXECUTIVE	47	49
OOCL EXPLORER	107	115
OOCL EXPORTER	57	
OOCL FAIR	131	90
OOCL FAITH	60	
OOCL FORTUNE	108	108
OOCL FREEDOM	123	
OOCL FRIENDSHIP	23	
ORANGE BLOSSOM	101	185
ORANGE STAR		32
ORCHID	23	
OREGON RAINBOW II	30	119
ORION HIGHWAY	114	122
OVERSEAS BOSTON	17	25
OVERSEAS CHICAGO	45	2
OVERSEAS HARRIET	54	69
OVERSEAS JOYCE	62	45
OVERSEAS JUNEAU	18	96
OVERSEAS MARILYN	35	
OVERSEAS NEW ORLEANS	54	92
OVERSEAS NEW YORK	41	67
OVERSEAS OHIO	27	73
OVERSEAS VIVIAN	1	
PACASIA	21	23
PACBARON	7	
PACDUCHESS	39	
PACDUKE	26	
PACGLORY	5	
PACIFIC EMERALD	58	120
PACIFIC PRINCESS	39	
PACIFIC SONG	14	
PACKING	89	
PACMERCHANT	41	4
PACPRINCE	24	
PACPRINCESS	76	37
PACQUEEN	35	
PACSEA	9	
PACSTAR	49	
PACSUN	30	33
PACTRADER	16	
PAPAGO	121	82
PAPYRUS	107	99
PARIS SENATOR	40	
PATRIOT	86	29
PATRIOT STATE		9
PAUL BUCK	55	47
PAUL H. TOWNSEND	285	329
PAUL R. TREGURTHA	278	295
PECAN,MANILA	146	
PECOS	55	
PEGGY DOW	18	
PELANDER	18	
PERMEKE	52	91
PETROBULK PROGRESS	5	
PFC DEWAYNE T. WILLIAM	10	
PFC EUGENE A. OBREGON	11	
PFC JAMES ANDERSON JR	20	
PFC WILLIAM B. BAUGH	14	
PHAROS	67	
PHILIP R. CLARKE	191	209
POLAR ALASKA	32	81
POLYNESIA	242	256
PONCE		108
POTOMAC TRADER	11	23
PRESIDENT ADAMS	81	91
PRESIDENT ARTHUR	13	156
PRESIDENT BUCHANAN	28	55
PRESIDENT EISENHOWER	125	109
PRESIDENT F. ROOSEVELT	31	124
PRESIDENT GARFIELD	16	
PRESIDENT GRANT	54	130
PRESIDENT HARDING	75	56
PRESIDENT HARRISON	67	
PRESIDENT HOOVER	43	153
PRESIDENT JACKSON	153	129
PRESIDENT JEFFERSON	45	85
PRESIDENT JOHNSON	56	
PRESIDENT KENNEDY	102	116
PRESIDENT LINCOLN	138	200
PRESIDENT MADISON	29	59
PRESIDENT MONROE	164	125
PRESIDENT PIERCE	51	71
PRESIDENT POLK	162	167
PRESIDENT TAFT	10	
PRESIDENT TRUMAN	105	27
PRESIDENT TYLER	60	151
PRESIDENT WASHINGTON	147	53
PRESQUE ISLE	325	364
PRIDE OF BALTIMORE II,	56	21
PRINCE OF OCEAN,PANAMA	107	142
PRINCE OF TOKYO	85	100
PRINCE OF TOKYO 2	61	162
PRINCE WILLIAM SOUND	48	148
PRINSENGRACHT	25	
PROOF GALLANT,LIBERIA		60
PROSPERO	52	83
PUERTO CORTES	1	
PURITAN	21	
PVT FRANKLIN J. PHILLI	14	6
QUALITY OF LIFE	30	
QUEEN ELIZABETH 2	69	
QUEENSLAND STAR	179	
R. HAL DEAN,BAHAMAS	27	15
RAINBOW BRIDGE	153	
RAINBOW HOPE	20	
RAINBOW WARRIOR	46	57
RALEIGH BAY	47	149
RANGER	57	3
RANGER III,USA	82	90
RANI PADMINI	114	
RECIFE	56	
REFORM	35	
RESERVE	9	17
RESOLUTE	49	67
RICHARD G MATTIESEN	10	
RICHARD REISS	3	
RICHARD REISS,USA	38	61
ROBERT E. LEE	26	28
ROGER BLOUGH	26	30
ROSEBANK	105	
ROSETTA	49	31
ROSINA TOPIC	25	18
ROTTERDAM	3	
ROVER	11	129
ROWANBANK	2	
ROYAL PRINCESS	85	
RUBIN DOGA	27	
RUBIN OCEAN	45	43
RUBIN STEIN	25	26
RUTH LYKES	20	38
S.T. CRAPO	125	160
S.T.SEAL ISLAND,LIBERI		13
S/S CHESAPEAKE,USA	53	103
S/S DAVID PACKARD,BAHA		112
SALINA CRUZ	267	161
SALINAS	22	67
SAM HOUSTON	15	
SAMUEL H ARMACOST,BAHA	73	42
SAMUEL L. COBB	40	33
SAN MARTIN	67	
SAN PEDRO	88	
SANKO PIONEER	36	42
SANKO PRELUDE	36	97
SANSINENA II	41	10
SANTA BARBARA	45	
SANTA MARTA	1	28
SANTA MONICA	9	
SANTOS	73	
SAPAI	2	27
SATURN DIAMOND	26	
SAVANNAH	37	
SCAN	2	3
SCARAB	95	51
SCHACKENBORG	24	36
SEA BELLS	18	190
SEA COMMERCE	23	
SEA FAN	43	123
SEA FORTUNE	37	79
SEA FOX	46	15
SEA LIGHT	22	35
SEA LION	33	319
SEA MERCHANT	371	
SEA WEALTH	32	92
SEA WOLF	102	93
SEALAND ACHIEVER	201	171
SEALAND ANCHORAGE	33	93
SEALAND ATLANTIC	60	72
SEALAND CHALLENGER	85	150
SEALAND CONSUMER	138	115
SEALAND CRUSADER	142	88
SEALAND DEFENDER	126	132
SEALAND DEVELOPER	31	62
SEALAND DISCOVERY	45	82
SEALAND ENDURANCE	47	76
SEALAND ENTERPRISE	223	235
SEALAND EXPEDITION	38	47
SEALAND EXPLORER	70	102
SEALAND EXPRESS	78	217
SEALAND HAWAII	202	220
SEALAND INNOVATOR	92	117
SEALAND INTEGRITY	64	111
SEALAND KODIAK	27	50
SEALAND LIBERATOR	51	58
SEALAND MARINER	42	67
SEALAND NAVIGATOR	229	176
SEALAND PACER	3	
SEALAND PACIFIC	183	210
SEALAND PATRIOT	63	144
SEALAND PERFORMANCE	44	110
SEALAND PRODUCER	72	236
SEALAND QUALITY	21	8

	RADIO	MAIL
SEALAND RELIANCE	101	160
SEALAND SPIRIT	59	205
SEALAND TACOMA	59	146
SEALAND TRADER	205	229
SEALAND VALUE	66	144
SEALAND VOYAGER	25	129
SEAWARD BAY	52	
SEDCO/BP 471	289	148
SEMINOLE	88	108
SENATOR	47	
SGT WILLIAM A BUTTON	35	
SGT. METEJ KOCAK	13	
SHELDON LYKES	58	
SHELLY BAY	66	32
SHENAHON	2	3
SHIRAOI MARU	132	33
SHOSHONE SPIRIT	162	74
SHOWA MARU,LIBERIA	14	69
SITHEA	8	13
SKANDERBORG	52	38
SKAUBRYN	140	
SKAUGRAN	151	159
SKODSBORG	32	59
SOLAR WING	94	136
SONBAI	8	
SONORA	81	78
SOUTHLAND STAR	161	
SPRING BEAR	108	
ST. CLAIR	194	221
STAR EAGLE	91	57
STAR EVVIVA	27	
STAR FLORIDA	60	
STAR FRASER	83	
STAR FUJI	4	
STAR GEIRANGER	7	27
STAR GEORGIA	2	
STAR GRAN	14	68
STAR GRINDANGER	18	27
STAR HONG KONG	115	
STAR LIVORNO	81	
STAR MASSACHUSETTS	2	
STAR MERCHANT	22	77
STAR MINERVA	44	40
STAR OREGON	31	19
STAR STRONEN	20	
STAR WILMINGTON	43	
STATE OF MAINE		22
STELLA LYKES	7	9
STEWART J. CORT	430	461
STONEWALL JACKSON	23	
STRIDER ISIS	116	156
STUTTGART EXPRESS	26	
SUE LYKES	41	33
SUGAR ISLANDER	14	
SUNBELT DIXIE	145	78
SUNRISE RUBY	66	185
SWIFTNES	17	
T.S.EMPIRE STATE	25	
TABASCO	78	
TAI CHUNG	84	66
TAI HE	87	
TAI SHAN	4	
TAI SHING	7	24
TAMPA	12	
TAMPA BAY	77	56
TARKWA,NORWAY	47	
TERNOZA	9	
TEXACO WESTCHESTER	70	
TEXAS CLIPPER	17	78
THE KWINI,BAHAMAS	63	117
THOMPSON LYKES		90
TILLIE LYKES	40	102
TOHZAN	37	56
TOLUCA	109	38
TONCI TOPIC	17	64
TONSINA	26	78
TORRENS	5	
TOWER BRIDGE	69	
TRANSWORLD BRIDGE	150	50
TRIGGER	123	110
TRITON	229	319
TROPIC SUN	2	
TROPICAL BEAUTY		79
TROPICALE	43	
TULSIDAS	1	
TYSON LYKES	40	82
UCHOA	116	167

	RADIO	MAIL
ULTRAMAR	16	82
ULTRASEA	20	
UNAMONTE	4	
UNIVERSE	31	
USCGC ACACIA (WLB406)	16	24
USCGC ACTIVE WMEC 618	31	
USCGC ACUSHNET WMEC 16	7	
USCGC ALERT (WMEC 630)	16	
USCGC BASSWOOD (WLB 38	60	
USCGC BEAR (WEMC 901)	28	
USCGC BISCAYNE BAY	1	4
USCGC BOUTWELL WHEC 71	137	
USCGC BRAMBLE (WLB 392	22	4
USCGC CAMPBELL	29	
USCGC CHASE (WHEC 718)	79	
USCGC CITRUS (WMEC 300	59	
USCGC CONFIDENCE WMEC6	3	22
USCGC COURAGEOUS	6	
USCGC DALLAS (WHEC 716	1	
USCGC DEPENDABLE	12	
USCGC DURABLE (WMEC 62	20	
USCGC EAGLE (WIX 327)	65	71
USCGC ESCANABA	2	
USCGC ESCAPE (WMEC 6)	98	139
USCGC FIREBUSH WLB 393	6	
USCGC FORWARD	59	
USCGC GALLATIN	36	24
USCGC GALVESTON ISLAND	10	
USCGC HAMILTON WHEC 71	43	31
USCGC HARRIET LANE	26	
USCGC IRONWOOD (WLB 29	22	
USCGC JARVIS (WHEC 725	8	
USCGC KATMAI BAY	1	
USCGC LAUREL (WLB 291)	2	
USCGC LEGARE		8
USCGC MACKINAW	46	42
USCGC MALLOW (WLB 396)	39	
USCGC MELLON (WHEC 717	18	59
USCGC MOHAWK WMEC 913	63	
USCGC MUNRO	3	
USCGC NORTHLAND WMEC 9	44	21
USCGC PLANETREE	4	
USCGC POLAR SEA__(WAGB	375	163
USCGC POLAR STAR (WAGB	317	194
USCGC RELIANCE WMEC 61	38	
USCGC RUSH	184	
USCGC SEDGE (WLB 402)	14	
USCGC SENECA	117	76
USCGC SPENCER	13	41
USCGC STORIS (WMEC 38)	30	37
USCGC SUNDEW (WLB 404)	41	71
USCGC SWEETBRIER WLB 4	33	
USCGC TAHOMA	27	
USCGC TAMAROA (WMEC 16	60	
USCGC TAMPA WMEC 902	27	30
USCGC VENTUROUS WMEC 6	31	
USCGC VIGILANT WMEC 61	15	
USCGC YOCONA (WMEC 168	6	77
USNS ALGOL	13	
USNS ALTAIR	7	
USNS ANTARES	1	
USNS BARTLETT(T-AGOR 1	161	
USNS BELLATRIX	2	
USNS CHAUVENET TAGS 29	5	
USNS DE STEIGUER	50	112
USNS DENEBOLA	9	
USNS GUS W. DARNELL	70	24
USNS HARKNESS (T-AGS 3	43	92
USNS INDOMITABLE	66	
USNS JOHN MCDONNELL (T	17	94
USNS LEROY GRUMMAN	1	
USNS LITTLEHALES (T-AG		8
USNS MERCURY	80	110
USNS MOHAWK (T-ATF 170	41	
USNS NAVAJO_(TATF-169)	104	
USNS PECOS		54
USNS POTOMAC	31	
USNS POWHATAN TATF 166	42	43
USNS REDSTONE	79	
USNS REGULUS	8	
USNS RELENTLESS	3	
USNS SEALIFT ANTARCTIC	22	32
USNS SEALIFT ARABIAN S	6	
USNS SEALIFT ARCTIC	4	
USNS SEALIFT ATLANTIC	90	114
USNS SEALIFT CARIBBEAN	34	49

	RADIO	
MAIL		
USNS SEALIFT CHINA SEA	1	
USNS SEALIFT INDIAN OC	2	
USNS SEALIFT MEDITERRA	136	157
USNS SEALIFT PACIFIC		31
USNS SILAS BENT T-AGS	42	
USNS SIOUX		136
USNS SPICA (T-AFS 9)		47
USNS VANGUARD TAG 194	52	
USNS VICTORIOUS	104	41
USNS WALTER S. DIEHL	1	
USNS WILKES T-AGS-33	90	66
VERA ACORDE	5	
VIKING ACE	71	93
VINE	164	
WALTER J. MCCARTHY	259	316
WASHINGTON RAINBOW #2	43	29
WECOMA	111	123
WELLINGTON STAR	176	
WEST MOOR	1	
WESTERN FUTURE	8	7
WESTWARD	8	
WESTWARD VENTURE	141	105
WESTWOOD ANETTE	62	54
WESTWOOD BELINDA	6	
WESTWOOD CLEO	52	116
WESTWOOD JAGO	114	70
WESTWOOD MARIANNE	27	145
WHITING SEA	46	
WILFRED SYKES	191	251
WILLIAM E. MUSSMAN	5	107
WILLIAM R. ROESCH	68	90
WOLVERINE	81	108
WORLD WING #2	91	
YANKEE CLIPPER	32	
YOKOHAMA	22	15
YOUNG SPROUT, PORT VIL	55	87
ZETLAND	242	
ZIM AMERICA	48	
ZIM CALIFORNIA	52	
ZIM CANADA	45	
ZIM HOUSTON	41	
ZIM IBERIA	54	
ZIM KEELUNG	76	
ZIM KINGSTON III	320	
ZIM MARSEILLES	13	
ZIM MIAMI	68	
ZIM SAVANNAH	49	
ZOELLA LYKES	86	

SUMMARY: GRAND TOTAL VIA RADIO 59729

GRAND TOTAL VIA MAIL 52304

TOTAL UNIQUE OBS 84544

TOTAL DUPLICATES 27489 (32.5%)

UNIQUE RADIO OBS.32240 (38.1%)

UNIQUE MAIL OBS. 24815 (29.4%)

July, August, and September 1992

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
A8VI	35	35	0	PACDUCHESS
BOAB	69	69	0	TAI HE
CGBS	109	0	109	PARIZEAU
CGDG	7	0	7	HUDSON
CGDV	136	0	136	W. TEMPLEMAN
CG2676	22	0	22	SHAMOOK
CG268	2	2	0	ALFRED NEEDLER
CG2683	53	46	7	ALFRED NEEDLER
CG2958	55	0	55	TULLY
CG2965	39	39	0	RICKER
CTFK	8	8	0	ALVARES CABRAL
CTU30	59	59	0	***
CZDO	18	18	0	***
CZGD	1	1	0	IROQUOIS
C6HL8	39	39	0	COLUMBIA STAR
C6IO	62	62	0	MANICHE
C6JY6	142	142	0	MELBOURNE STAR
C6JZ2	124	124	0	AMERICAN STAR
C6JZ3	50	50	0	QUEENSLAND STAR
DAKE	252	214	38	KOELN ATLANTIC
DA9100	244	244	0	PLATFORM NORDSEE
DBLK	19	19	0	POLAR STERN
DD8436	47	47	0	FEHRMAN BELT
DESI	134	84	50	VALDIVIA
DGLM	64	64	0	MONTE ROSA
DGVK	40	40	0	COLUMBUS VICTORIA
DGZV	84	84	0	COLUMBUS VIRGINIA
DHCW	78	78	0	COLUMBUS WELLINGTON
DIDA	8	8	0	ARIANA
DLEZ	37	37	0	YANKEE CLIPPER
D5BC	72	72	0	SEDCO/BP471
D5NE	85	85	0	MT CABRITE
D5NZ	134	134	0	POLYNESIA
ELBX3	66	66	0	PACKING
ELDM8	40	40	0	TROLL FORREST
ELEH6	1	1	0	***
ELHL6	104	104	0	COLUMBUS OHIO
ELIL9	76	76	0	NAVIGATOR
ELIS	61	61	0	MARINER
EREC	4	0	4	PRILIV
EREU	62	50	12	ERNST KRENKEL
FITA	36	36	0	NOROIT
FNCZ	59	59	0	DELMAS SURCOUF
FNGS	71	71	0	LA FAYETTE
FNJT	4	4	0	KORRIGAN
FNOM	4	4	0	RENOIR
FNQB	15	15	0	ILE MAURICE
FNQM	51	51	0	SUZANNE DELMAS
FNXW	4	4	0	SAINT ROCH
FNZB	19	19	0	SAINT ROLAND
FNZO	28	28	0	RABELAIS
FNZP	51	51	0	RACINE
FNZQ	31	31	0	RIMBAUD
GACA	99	99	0	CUMULUS
GQEK	48	48	0	FORTHBANK
GYRW	52	52	0	ENCOUNTER BAY
GYSA	41	41	0	FLINDERS BAY
GYSE	34	34	0	NEDLLOYD TASMAN
HPAN	22	22	0	MICRONESIAN COM-
MERCE				
HPEW	51	51	0	PACIFIC ISLANDER
H9BQ	21	21	0	MICRONESIAN INDE-
PENDENCE				
JBOA	36	36	0	KEIFU MARU
JCCX	46	46	0	CHOFU MARU
JCDF	11	11	0	SOYO MARU
JCOD	25	25	0	SHOYO
JDRD	34	34	0	SHOYO MARU
JDWX	68	68	0	KOFU MARU
JFDG	90	90	0	SHUMPU MARU
JFPQ	22	22	0	KASHIMASAN MARU
JGZK	51	51	0	RYOFU MARU
JITV	146	146	0	WELLINGTON MARU
JKCF	83	83	0	GEORGE WASHINGTON
JPVB	71	71	0	SEIFU MARU
J8FN	2	2	0	ROWEN BANK
J8FO	65	65	0	ROSEBANK
KGJB	50	50	0	SEALAND DEFENDER
KIRH	85	85	0	SEALAND TRADER
KNBD	9	9	0	DELAWARE II
KNDB	1	1	0	RAINBOW HOPE
KNFG	45	45	0	SEA WOLF
KRGB	365	365	0	SEALAND ENTERPRISE
LADB2	112	112	0	SKAUGRAN
LAJV4	63	63	0	SKAUBRYN
LLZG	5	0	5	***
NAVOCE	254	254	0	U.S. NAVAL OCEANOGRAPHIC
NBTM	8	8	0	POLAR STAR
NICB	2	2	0	***
NIDK	32	32	0	ICEPAT GROTON CT
NJVF	2	2	0	***
NLPM	1	1	0	CHASE
NMEL	1	1	0	MELLON
NMST	3	3	0	MAHLON S. TISDALE
NOZX	1	1	0	GOLDSBOROUGH
NRUO	93	93	0	POLAR SEA
NTRI	26	26	0	WILKES
NVIC	2	2	0	***
OWUO6	78	78	0	MOANA PACIFIC
PGDI	49	49	0	NEDLLOYD MANILA
PGDY	50	50	0	NEDLLOYD MADRAS
PGEC	35	35	0	NEDLLOYD VAN NOORT
PGFE	23	23	0	NEDLLOYD VAN DIEMEN
PJJU	65	65	0	OLEANDER
RVO	1	1	0	***
SCOU	1	1	0	TV 243
SCOV	1	1	0	TV 244
SEXN	8	8	0	TV 227
SEXQ	4	4	0	TV 278
SEYD	8	8	0	TV 274
SHIP	597	593	4	***
SJIB	3	3	0	TV 282
SKVP	10	10	0	TV 284
SMJZ	2	2	0	***
SMZQ	4	4	0	TV 102
S6FK	138	138	0	SWAN REEFER
TFEA	62	62	0	BJARNI SAEMUNDSSON
UINF	14	13	1	VLADIMIR PARSHIN
UVMM	23	22	1	GAKKEL, YAKOV
VC9450	144	0	144	GADUS ATLANTICA
VC9616	6	0	6	LADY HAMMOND
VJBQ	26	26	0	ANRO AUSTRALIA
VJDI	26	26	0	IRON NEWCASTLE
VJDP	88	88	0	IRON PACIFIC
VKCN	116	116	0	CANBERRA
VKCV	81	81	0	DERWENT
VKLA	62	62	0	ADELAIDE
VKLB	8	8	0	HOBART
VKLC	32	32	0	BRISBANE
VKLP	10	10	0	***
VKML	42	42	0	SYDNEY
VKMS	2	2	0	COOK
VKPT	37	37	0	PERTH
VLNB	81	81	0	TORRENS
VP47	3	3	0	AIRCRAFT SQUADRON

Bathy–Tesac Data at NMC

July, August, and September 1992

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VSBI3	16	16	0	BIBI
VXN8	791	791	0	AIRCRAFT
WCGN	58	58	0	CHEVRON CALIFORNIA
WLDZ	7	7	0	MAURICE EWING
WPGK	97	97	0	SEALAND NAVIGATOR
WPKD	75	75	0	SEALAND ACHIEVER
WRBA	4	4	0	PACMISRANFAC HAWAREA
WRBB	3	3	0	PACIFIC MISSLE RANGE
WSRL	90	90	0	SEALAND PACIFIC
WTDF	1	1	0	TOWNSEND CROMWELL
WTDK	79	79	0	D.S. JORDAN
WTDM	48	38	10	MILLER FREEMAN
WTDO	20	5	15	OREGON II
WTEA	11	11	0	DISCOVERER
WTEG	23	21	2	MOUNT MITCHELL
WTEJ	37	37	0	MCARTHUR
WTER	92	75	17	MALCOLM BALDRIGE
WTEW	13	13	0	WHITING
WUS9293	2	2	0	MOANA WAVE
WWZZ	60	60	0	***
WXBR	24	24	0	CHEVRON MISSISSIPPI
YDLR	38	38	0	BOGASARI LIMA
Y3CH	12	0	12	PROF. ALBRECHT PENCK
Y3CW	27	0	27	A. V. HUMBOLDT
ZCAQ9	232	232	0	WESTMOOR
ZCKU	29	29	0	STAR MAGNATE
ZDAZ	50	50	0	EXPLORER
ZDBE9	70	70	0	VOYAGER
3EAW7	22	22	0	ANDINO
3EET4	49	49	0	SEAS EIFFEL
3EKW	36	36	0	UTRILLO
7JOB	5	5	0	CALIFORNIA CERES
7KDD	36	36	0	YOKO MARU
9VUU	28	28	0	ANRO ASIA
9VVB	123	123	0	GOLDENSARI INDAH
9VWM	14	14	0	MANDAMA
21002	615	615	0	BUOY
21004	712	712	0	BUOY
22001	698	698	0	BUOY
32315	54	54	0	BUOY
32316	5	5	0	BUOY
32317	4	4	0	BUOY
32318	7	7	0	BUOY
32319	132	132	0	BUOY
43001	11	11	0	BUOY
51006	20	20	0	BUOY
51007	1	1	0	BUOY
51008	12	12	0	BUOY
51009	2	2	0	BUOY
51010	26	26	0	BUOY
51014	22	22	0	BUOY
51015	2	2	0	BUOY
51016	1	1	0	BUOY
51018	2	2	0	BUOY
51019	8	8	0	BUOY
51021	7	7	0	BUOY
51022	35	35	0	BUOY
51023	3	3	0	BUOY
51301	11	11	0	BUOY
51302	17	17	0	BUOY
51303	3	3	0	BUOY
51304	2	2	0	BUOY
51305	1	1	0	BUOY
51306	2	2	0	BUOY
51308	1	1	0	BUOY
51309	1	1	0	BUOY
51310	1	1	0	BUOY
CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
52001	2	2	0	BUOY
52003	9	9	0	BUOY
52004	4	4	0	BUOY
52007	9	9	0	BUOY
52011	1	1	0	BUOY
52301	9	9	0	BUOY
52302	5	5	0	BUOY
52303	41	41	0	BUOY
52304	29	29	0	BUOY
52305	65	65	0	BUOY
52307	39	39	0	BUOY

TOTAL BATHYS RECEIVED 11602
TOTAL TESACS RECEIVED 684
TOTAL REPORTS RECEIVED 12286

July, August, and September 1992

Wave observations are taken each hour during a 20–minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one–third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0–minute averaging period each hour (moored buoys) and a 2.0–minute averaging period for fixed stations (C–MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688–2838 for more details.

JULY 1992

MEAN	MEAN	MEAN SIG	MAX SIG	MAX SIG	SCALAR MEAN	PREV	MAX	MAX	MEAN				
BUOY	LAT	LONG	OBS	AIR TP	SEA TP	WAVE HT	WAVE HT	WAVE HT	WIND SPEED	WIND	WIND	WIND	PRESS
(C)	(C)	(M)		(M)	(DA/HR)	(KNOTS)	(DIR)	(KTS)	(DA/HR)	(MB)			
32302	18.0S	085.1W	0740	18.5	19.7	2.4	3.9	14/10	14.3	SE	26.0	14/07	1019.2
41001	34.9N	073.0W	0150	24.6	25.2	1.3	2.0	02/08	11.0	S	24.9	07/05	1013.7
41002	32.3N	075.2W	0739	27.4	27.4	1.3	2.6	02/19					1018.1
41004	32.5N	079.1W	0736	27.6	28.1	0.8	1.8	28/04	11.3	SW	24.7	01/22	1018.0
41006	29.3N	077.4W	0738	27.9	28.4	0.9	1.5	03/23	9.7	SW	19.8	28/08	1019.7
41009	28.5N	080.2W	1481	27.8	28.2	0.5	1.1	24/21	8.0	SE	19.4	06/23	1019.8
41010	28.9N	078.5W	1453	28.2	28.8	0.8	1.6	29/09	9.2	S	22.9	03/21	1019.8
41016	24.6N	076.5W	0743	28.0	28.9	0.3	0.5	27/13	10.9	E	25.5	18/04	1018.9
42001	25.9N	089.7W	0739	28.7	29.5	0.6	1.8	01/14	9.2	SE	23.7	01/11	1018.5
42002	25.9N	093.6W	0744	28.8	29.2	0.8	2.2	01/22	10.5	SE	21.2	01/14	1017.3
42003	25.9N	085.9W	0744	28.7	29.3	0.6	1.7	13/09	8.4	E	25.3	13/05	1018.9
42007	30.1N	088.8W	0744	28.4	29.4				10.2	SW	27.0	24/12	1017.9
42019	27.9N	095.0W	0740	28.6	28.8	1.1	2.5	02/11	10.4	S	22.0	01/05	1016.3
42020	27.0N	096.5W	0742	28.2	28.3	1.0	2.1	02/07	11.4	SE	23.3	03/20	1015.6
42025	24.9N	080.4W	0739	29.4									
44004	38.5N	070.7W	0742							SW	23.5	16/03	1015.2
44005	42.6N	068.6W	0720	15.8	15.1	0.9	1.7	01/05	8.4	SW	24.7	02/05	1013.3
44007	43.5N	070.1W	0742	16.6	14.8	0.5	1.7	09/16	9.0	S	29.5	09/13	1012.8
44008	40.5N	069.4W	0742	16.6	14.1	0.9	2.1	10/06	10.3	SW	25.3	24/06	1013.9
44009	38.5N	074.7W	0737	23.0	22.4	0.7	1.9	02/17	11.0	S	25.3	09/08	1014.6
44011	41.1N	066.6W	0727	15.2	13.6	1.1	3.0	09/23	8.9	SW	26.4	09/18	1014.8
44012	38.8N	074.6W	0738	22.5	21.8	0.8	1.9	02/16	11.0	S	26.4	05/08	1014.2
44013	42.4N	070.8W	0741	18.1	15.6	0.3	0.9	04/15	9.1	SE	20.2	13/15	1013.6
44014	36.6N	074.8W	0739	23.9		0.9	1.9	16/00	8.9	S	22.7	17/23	1014.9
44025	40.3N	073.2W	0699	21.2	20.2	0.9	2.0	04/11	9.7	SW	22.3	15/05	1013.9
45001	48.1N	087.8W	0743	6.5	4.2	0.5	1.9	04/17	7.6	SW	21.0	02/22	1012.9
45002	45.3N	086.4W	0743	14.3	13.4	0.5	1.7	02/01	7.9	S	24.1	02/00	1013.6
45003	45.3N	082.7W	0742	11.6	9.9	0.5	2.1	20/18	8.0	NW	24.9	27/15	1013.5
45004	47.5N	086.5W	0732	6.6	4.6	0.4	1.9	04/22	7.7	W	21.8	03/03	1012.9
45005	41.7N	082.4W	0735	20.5	21.2	0.5	2.3	31/03	10.3	SW	28.6	31/13	1013.6
45006	47.3N	089.9W	0741	9.4	6.5	0.5	2.3	03/01	6.6	SW	18.1	02/20	1013.3
45007	42.8N	087.1W	0739	16.9	16.4	0.5	1.7	31/03	8.9	NE	22.9	23/11	1013.6
45008	44.3N	082.4W	0740	14.3	13.7	0.5	1.8	21/00	7.0	NE	18.8	14/11	1014.2
46001	56.3N	148.3W	0742	11.0	11.8	1.6	3.3	09/07	11.9	W	21.4	22/05	1015.1
46002	42.5N	130.3W	0739	16.1	17.1	1.8	3.1	09/14	12.9	N	22.5	09/17	1021.1
46003	51.9N	155.9W	0735	10.0	10.1	1.9	4.0	08/09	13.4	SW	24.9	08/09	1017.7
46005	46.1N	131.0W	0736	14.7	15.7	1.7	3.1	18/19	11.8	N	22.0	19/23	1021.6
46006	40.9N	137.5W	0742	16.4	17.7	1.4	3.0	01/02	8.3	N	17.9	17/17	1025.5
46011	34.9N	120.9W	0742	15.0	14.4	1.5	2.8	21/10	10.2	NW	21.0	02/00	1014.5
46012	37.4N	122.7W	0741	15.0	15.4	1.4	3.0	24/14	7.6	NW	24.9	23/00	1015.7
46013	38.2N	123.3W	0739	13.8	13.3	1.5	3.3	24/00	9.9	NW	27.2	24/02	1014.5
46014	39.2N	124.0W	0741	13.7	13.7	1.6	3.1	10/17	8.6	NW	25.3	23/04	1015.1
46022	40.8N	124.5W	0738	13.7	13.3	1.7	3.6	09/06	8.2	N	19.2	08/12	1016.2
46023	34.3N	120.7W	0741	15.7	15.3	1.7	3.1	24/20	14.0	NW	24.5	19/11	1014.1
46025	33.8N	119.1W	0741	18.6	19.9	1.0	2.2	20/05	5.4	W	19.6	01/04	1013.4
46026	37.8N	122.7W	0488	14.9	15.7	1.0	2.0	01/07	9.1	W	25.1	21/08	1014.9
46027	41.8N	124.4W	0700	13.2	12.9	1.8	3.4	09/04					1015.6
46028	35.8N	121.9W	0740	16.1		1.8	3.3	24/08	14.2	NW	29.1	20/23	1015.0
46029	46.2N	124.2W	0740	15.1	15.0	1.4	2.5	09/20	9.1	NW	19.3	16/01	1018.3
46035	57.0N	177.7W	0744	6.9	7.6	1.5	3.6	01/03	13.5	W	26.2	25/03	1012.8
46041	47.4N	124.5W	0738	14.1	14.5	1.3	2.3	09/16	7.8	NW	18.7	16/04	1017.5
46042	36.8N	122.4W	0740	15.1		1.6	3.2	24/01	10.1	NW	22.5	24/01	1015.7
46048	32.9N	117.9W	0742	19.3	20.7	1.1	2.2	20/19	7.5	NW	18.3	07/23	1013.2
46050	44.6N	124.5W	0739	14.7	13.8	1.6	2.5	10/04	9.2	N	19.6	26/11	1018.2
46051	34.5N	120.7W	0740	14.8	14.3	1.5	2.9	21/12	12.1	NW	21.6	19/11	1014.5
51001	23.4N	162.3W	0741	25.5	26.4	1.9	3.0	09/12	13.8	E	24.1	22/20	1016.9
51002	17.2N	157.8W	0738	26.1		1.9	4.3	26/13	14.0	E	29.0	26/08	1013.8
51003	19.3N	160.8W	0741	26.3	27.2	1.7	3.7	27/03	10.9	E	22.1	26/11	1013.8
51004	17.4N	152.5W	0743	25.9	26.9	1.9	4.9	25/22	12.9	E	29.2	25/22	1013.1
91222	18.1N	145.8E	0684	28.2					6.2	E	17.4	15/04	1012.0
91251	11.4N	162.4E	0734	27.7					12.3	E	29.6	16/05	1010.5
91328	8.6N	149.7E	0721	27.5					5.5	NE	22.6	25/08	1009.4

NDBC Station Data Summary

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
91343	7.6N	155.2E	0734	27.7					4.8	NE	22.9	16/03	1009.8
91355	5.4N	163.0E	0737	26.8					4.8	E	21.8	19/18	1009.1
91377	6.1N	172.1E	0739	27.7					5.7	NE	20.7	14/02	1009.2
ABAN6	44.3N	075.9W	0132	17.8	19.2				3.6	S	16.3	31/20	1011.3
ALSN6	40.5N	073.8W	0742	21.5	20.1	0.7	2.0	31/20	12.6	SW	28.9	09/06	1014.6
BURL1	28.9N	089.4W	0741	28.6					8.6	S	36.9	01/07	1018.7
BUSL1	27.9N	090.9W	0740	30.0	29.9				7.8	SE	24.7	16/02	1012.3
BUZM3	41.4N	071.0W	0380	17.8					11.1	SW	27.2	02/08	1014.5
CARO3	43.3N	124.4W	0740	13.7					7.9	NE	21.3	24/19	1016.9
CHLV2	36.9N	075.7W	0744	24.5	22.8	0.7	1.7	03/03	12.2	SW	30.5	23/21	1015.7
CLKN7	34.6N	076.5W	0741	27.0					10.6	SW	20.0	25/19	1017.2
CSBF1	29.7N	085.4W	0739	28.2					7.9	W	22.5	16/00	1018.5
DBLN6	42.5N	079.4W	0742	18.9					10.1	SW	29.0	05/08	1013.4
DESW1	47.7N	124.5W	0737	14.0					8.7	NW	28.3	16/02	1017.7
DISW3	47.1N	090.7W	0722	13.9					9.2	SW	33.4	02/19	1013.2
DPIA1	30.3N	088.1W	0743	28.3	29.8				8.0	SW	23.0	19/03	1018.4
DSLN7	35.2N	075.3W	0739	26.1	26.4	1.0	2.0	16/03	14.7	SW	30.8	15/23	1016.8
FBIS1	32.7N	079.9W	0740	27.8					8.9	SW	20.1	01/21	1017.4
FFIA2	57.3N	133.6W	0702	12.8					6.7	SW	22.5	12/01	1017.7
FPSN7	33.5N	077.6W	0702	27.4	27.2				14.0	SW	28.8	28/04	1017.7
FWYF1	25.6N	080.1W	0741	28.5	29.4				9.9	SE	21.9	18/00	1019.1
GBCL1	27.8N	093.1W	0743	28.5	30.0				10.6	SE	27.1	02/08	1017.7
GDIL1	29.3N	090.0W	0701	28.6	30.5				7.0	S	21.2	22/06	1017.7
GLLN6	43.9N	076.5W	0740	17.7					10.4	W	28.5	03/20	1013.3
IOSN3	43.0N	070.6W	0741	17.8					11.3	S	28.1	09/20	1013.1
MDRM1	44.0N	068.1W	0743	13.0					11.7	SW	30.0	13/19	1014.0
MISM1	43.8N	068.9W	0741	14.1					11.6	SW	24.5	13/17	1013.2
MLRF1	25.0N	080.4W	0741	28.4	29.4				9.5	E	31.0	19/05	1018.4
MPCL1	29.4N	088.6W	0614	27.9	28.9				8.7	SW	31.9	01/07	1018.8
NWPO3	44.6N	124.1W	0739	13.6					8.7	N	26.4	29/01	1017.8
PILM4	48.2N	088.4W	0742	9.6					10.6	W	28.2	04/12	1012.7
PTAC1	39.0N	123.7W	0741	13.4					7.6	N	22.5	23/11	1015.8
PTAT2	27.8N	097.1W	0742	27.4	28.5				12.2	SE	29.9	04/00	1015.3
PTGC1	34.6N	120.7W	0736	15.2					16.0	N	30.4	30/12	1014.5
ROAM4	47.9N	089.3W	0737	11.8	7.1				11.4	SW	35.3	02/22	1013.1
SANF1	24.5N	081.9W	0743	28.4	29.4				10.4	E	33.1	13/03	1018.3
SAUF1	29.9N	081.3W	0696	27.1	27.2				7.4	SW	19.2	30/19	1018.9
SBIO1	41.6N	082.8W	0556	21.5					10.8	SW	27.3	05/05	1011.9
SGNW3	43.8N	087.7W	0742	17.6					9.2	S	23.6	02/16	1013.5
SISW1	48.3N	122.9W	0740	13.6					8.6	SW	22.9	26/06	1017.1
SMKF1	24.6N	081.1W	0742	28.8	29.7				10.9	E	27.4	05/01	1018.5
SPGF1	26.7N	079.0W	0742	28.1	29.8				4.3	SE	20.7	11/21	1019.9
SRST2	29.7N	094.1W	0743	28.2					10.8	S	23.6	01/02	1016.4
STDM4	47.2N	087.2W	0742	11.9					14.3	SE	33.7	20/08	1012.5
SVLS1	32.0N	080.7W	0739	27.0		0.6	1.2	01/10	11.6	SW	41.9	01/20	1018.4
TPLM2	38.9N	076.4W	0743	24.7	24.8				10.1	S	34.7	31/22	1014.3
TTIW1	48.4N	124.7W	0742	13.7					7.5	S	27.7	31/18	1018.0
VENF1	27.1N	082.5W	0742	27.1	30.2				6.7	E	23.8	12/20	1018.7
WPOW1	47.7N	122.4W	0738	16.1					3.9	N	15.3	23/16	1016.2
AUGUST 1992													
32302	18.0S	085.1W	0730	17.7	19.1	2.4	5.5	22/23	13.5	SE	23.1	01/03	1019.0
41001	34.9N	073.0W	0484	26.2	27.2	1.4	3.0	29/15	11.6	S	24.5	29/04	1019.3
41002	32.3N	075.2W	0031	28.4	28.1	0.8	1.1	01/09					1016.8
41004	32.5N	079.1W	0739	26.9	27.8	0.9	3.1	24/18	9.3	SW	29.0	14/21	1018.7
41006	29.3N	077.4W	0738	28.3	29.3	1.0	3.4	24/06	8.3	S	20.4	29/05	1019.0
41009	28.5N	080.2W	1477	27.4	28.2	0.6	3.2	24/07	7.2	S	26.6	04/22	1018.9
41010	28.9N	078.5W	1417	28.4	29.3	1.0	4.4	24/05	8.4	S	25.5	14/07	1019.0
41016	24.6N	076.5W	0740	28.4	29.4	0.5	1.7	24/06	10.8	E	28.5	23/23	1017.6
42001	25.9N	089.7W	0739	28.3	29.7	0.6	4.4	25/12	8.6	E	26.4	21/19	1017.3
42002	25.9N	093.6W	0741	28.5	29.6	0.6	3.4	25/21	7.3	SE	28.4	20/16	1016.8
42003	25.9N	085.9W	0741	28.4	29.6	0.6	6.4	25/02	8.6	SE	45.5	25/02	1017.5
42007	30.1N	088.8W	0738	27.1	28.9				9.4	SE	29.9	25/18	1016.7
42019	27.9N	095.0W	0739	28.0	29.0	0.6	1.7	26/13	7.8	SE	26.0	23/16	1016.2
42020	27.0N	096.5W	0738	28.0	28.6	0.6	2.7	26/04	8.4	SE	23.5	23/16	1016.0
42025	24.9N	080.4W	0737										
44004	38.5N	070.7W	0734	23.8	24.8					SW	29.5	29/05	1019.0
44005	42.6N	068.6W	0712	17.9	17.4	0.9	2.4	30/11	10.0	SW	22.2	01/08	1017.7
44007	43.5N	070.1W	0740	17.2	15.5	0.6	2.0	29/12	9.3	SW	34.9	01/04	1016.8
44008	40.5N	069.4W	0741	19.5	18.2	1.0	2.6	14/14	10.0	S	35.0	14/13	1018.5
44009	38.5N	074.7W	0734	22.6	23.0	0.8	2.8	15/18	10.1	S	30.1	28/22	1018.5
44011	41.1N	066.6W	0697	19.0	18.9	1.2	3.1	14/20	9.4	W	27.4	14/15	1019.4
44012	38.8N	074.6W	0738	22.3	22.3	0.8	2.7	15/15	9.8	S	32.1	15/14	1018.3
44013	42.4N	070.8W	0736	18.6	16.0	0.3	1.6	16/10	9.9	SW	25.1	29/07	1017.7
44014	36.6N	074.8W	0734	23.7		1.0	2.3	28/22	7.8	E	19.2	01/12	1018.2
44025	40.3N	073.2W	0700	21.8	20.9	0.9	3.0	15/23	9.6	SW	28.4	15/19	1018.3
45001	48.1N	087.8W	0740	11.8	10.5	0.5	1.9	30/19	8.8	SW	24.1	30/18	1016.7
45002	45.3N	086.4W	0741	17.5	18.2	0.7	3.0	30/06	11.3	S	26.2	30/04	1017.7

NDBC Station Data Summary

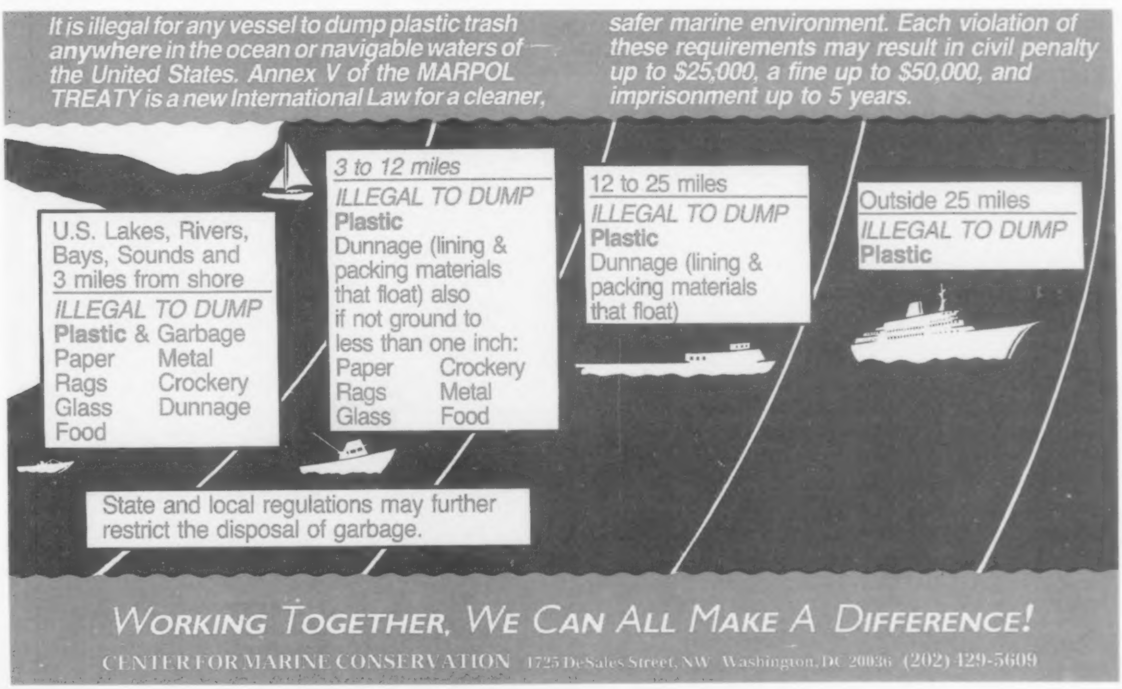
MEAN	MEAN	MEAN SIG		MAX SIG	MAX SIG	SCALAR MEAN	PREV	MAX	MAX MEAN				
BUOY	LAT	LONG	OBS	AIR TP	SEA TP	WAVE HT	WAVE HT	WAVE HT	WIND SPEED	WIND	WIND	WIND	PRESS
(C)	(C)	(M)		(M)	(DA/HR)	(KNOTS)	(DIR)	(KTS)	(DA/HR) (MB)				
45003	45.3N	082.7W	0739	15.2	14.7	0.6	2.8	31/05	10.4	NW	27.6	31/04	1017.0
45004	47.5N	086.5W	0730	11.2	9.7	0.5	2.2	30/23	8.2	NW	24.5	30/06	1016.7
45005	41.7N	082.4W	0736	20.2	21.7	0.6	1.8	15/12	9.8	SW	24.9	30/09	1018.3
45006	47.3N	089.9W	0741	15.6	15.2	0.5	2.3	30/09	7.2	SW	21.7	30/09	1017.2
45007	42.8N	087.1W	0737	18.6	19.2	0.6	2.1	28/05	10.3	N	24.7	30/03	1018.6
45008	44.3N	082.4W	0739	16.6	16.5	0.7	2.7	29/08	9.3	S	22.8	30/09	1018.1
46001	56.3N	148.3W	0712	12.1	12.5	1.9	4.1	23/19	12.3	S	25.6	23/16	1013.2
46002	42.5N	130.3W	0737	17.4	18.1	1.8	3.0	09/06	12.1	N	20.8	12/04	1021.5
46003	51.9N	155.9W	0735	11.0	11.2	2.1	5.6	19/21	14.6	SW	35.0	19/19	1013.4
46005	46.1N	131.0W	0734	16.1	16.6	1.7	3.4	21/05	11.4	N	21.2	21/10	1021.6
46006	40.9N	137.5W	0740	19.4	20.4	1.4	2.8	10/01	8.8	NE	18.1	05/20	1024.1
46011	34.9N	120.9W	0735	14.6	15.0	1.5	2.7	22/08	10.0	NW	22.2	22/20	1014.9
46012	37.4N	122.7W	0736	13.9	14.1	1.3	2.4	06/06	8.8	NW	19.4	22/04	1016.1
46013	38.2N	123.3W	0736	12.5	11.9	1.6	3.2	24/04	12.8	NW	29.7	05/23	1014.8
46014	39.2N	124.0W	0739	12.9	12.7	1.6	3.3	16/12	10.6	NW	24.3	16/09	1015.8
46022	40.8N	124.5W	0739	12.9	12.7	1.5	3.3	16/07	7.2	N	21.4	16/11	1017.2
46023	34.3N	120.7W	0738	15.2	15.7	1.6	2.7	06/06	15.0	NW	24.3	01/03	1014.3
46025	33.8N	119.1W	0740	19.7	21.2	0.9	1.9	23/06	6.2	W	19.8	30/03	1013.8
46027	41.8N	124.4W	0673	12.8	13.0	1.5	3.0	15/04					1016.7
46028	35.8N	121.9W	0738	14.5		1.7	3.1	23/03	14.2	NW	27.2	21/23	1015.3
46029	46.2N	124.2W	0734	14.8	14.0	1.4	2.6	09/19	8.0	NW	19.1	10/21	1019.2
46035	57.0N	177.7W	0741	8.4	8.8	1.9	4.8	14/23	14.2	W	29.9	14/10	1006.1
46041	47.4N	124.5W	0730	14.0	14.1	1.3	2.4	09/08	7.0	NW	19.2	12/02	1018.4
46042	36.8N	122.4W	0737	14.2		1.5	2.6	17/01	12.2	NW	27.0	03/20	1015.9
46047	32.7N	119.6W	0577	17.8	19.7	1.6	3.2	23/01	13.4	NW	25.6	23/01	1014.6
46048	32.9N	117.9W	0742	20.8	22.4	0.9	1.6	23/11	7.6	NW	19.6	20/20	1013.5
46050	44.6N	124.5W	0741	14.2	13.3	1.5	2.7	17/21	9.2	N	21.4	27/06	1018.8
46051	34.5N	120.7W	0741	14.6	15.3	1.6	2.8	22/23	13.5	NW	22.0	01/03	1014.7
51001	23.4N	162.3W	0741	26.1	26.8	1.8	2.4	20/08	15.0	E	23.7	08/09	1017.6
51002	17.2N	157.8W	0365	26.7	27.3	2.4	3.5	10/21	16.9	E	23.0	11/12	1014.3
51003	19.3N	160.8W	0741	26.7	27.4	2.0	3.5	13/03	13.5	E	28.8	13/06	1014.0
51004	17.4N	152.5W	0739	26.3	27.0	2.2	3.3	09/22	15.8	E	22.6	10/06	1013.4
91222	18.1N	145.8E	0675	28.1					7.4	E	21.9	12/06	1008.6
91251	11.4N	162.4E	0723	27.9					9.4	E	23.6	22/21	1010.0
91328	8.6N	149.7E	0238	27.6					5.1	S	17.6	02/03	1008.8
91343	7.6N	155.2E	0725	27.8					3.1	SW	16.2	09/11	1009.5
91355	5.4N	163.0E	0721	26.9					5.3	E	23.7	08/15	1009.1
91377	6.1N	172.1E	0728	27.8					5.2	NE	24.3	21/20	1009.6
9A222	18.1N	145.8E	0072	27.9									1008.4
ABAN6	44.3N	075.9W	0703	18.7	19.4				3.3	S	15.1	28/19	1017.9
ALSN6	40.5N	073.8W	0742	21.2	21.5	0.7	2.3	15/23	12.4	NW	39.5	29/02	1018.8
BURL1	28.9N	089.4W	0741	27.3					9.9	S	55.7	25/21	1017.3
CARO3	43.3N	124.4W	0742	13.5					6.8	NE	20.3	11/21	1017.6
CHLV2	36.9N	075.7W	0740	23.2	22.6	0.8	2.0	15/03	10.2	S	29.1	28/22	1019.2
CLKN7	34.6N	076.5W	0739	25.9					10.4	SW	31.3	10/07	1019.2
CSBF1	29.7N	085.4W	0740	27.1					6.8	W	29.5	27/19	1017.1
DBLN6	42.5N	079.4W	0740	18.9					9.3	SW	33.6	29/01	1017.8
DESW1	47.7N	124.5W	0740	13.9					8.0	NW	25.4	26/23	1018.6
DISW3	47.1N	090.7W	0742	17.4					8.8	SW	25.9	29/22	1017.2
DPIA1	30.3N	088.1W	0739	26.7	28.9				8.6	N	31.8	25/21	1017.4
DSLN7	35.2N	075.3W	0738	25.7	27.0	1.1	2.7	28/23	12.2	SW	37.4	14/04	1019.1
FBIS1	32.7N	079.9W	0737	26.7					8.9	SW	25.6	28/07	1018.2
FFIA2	57.3N	133.6W	0742	12.5					6.5	SE	25.0	16/05	1018.9
FPSN7	33.5N	077.6W	0739	26.7	27.3				11.7	SW	28.9	28/14	1018.8
FWYF1	25.6N	080.1W	0558	28.6	29.5				9.9	SE	22.5	24/08	1017.7
GBCL1	27.8N	093.1W	0621	27.6	29.9				8.2	SE	25.0	26/14	1017.0
GDIL1	29.3N	090.0W	0622	27.2	29.6				8.5	NE	47.9	25/22	1016.3
GLLN6	43.9N	076.5W	0738	18.9					12.0	SW	37.2	29/08	1017.2
IOSN3	43.0N	070.6W	0741	18.1					11.9	S	30.0	29/09	1018.6
MDRM1	44.0N	068.1W	0740	13.9					12.2	SW	28.0	01/10	1017.6
MISM1	43.8N	068.9W	0742	14.7					12.2	SW	28.5	29/11	1017.3
MLRF1	25.0N	080.4W	0738	28.5	29.6				9.5	E	47.7	24/10	1017.1
NWPO3	44.6N	124.1W	0740	13.4					8.1	N	25.2	25/00	1018.5
PILM4	48.2N	088.4W	0739	14.1					10.8	W	29.3	30/04	1016.6
PTAC1	39.0N	123.7W	0741	12.4					9.3	N	19.5	17/01	1016.3
PTAT2	27.8N	097.1W	0741	27.6	29.4				10.1	SE	27.6	23/21	1015.9
PTGC1	34.6N	120.7W	0737	14.3					16.7	N	29.0	01/04	1014.7
ROAM4	47.9N	089.3W	0738	14.9	13.3				12.2	SW	32.8	08/00	1016.8
SANF1	24.5N	081.9W	0738	28.5	29.7				8.7	E	30.2	24/16	1017.0
SAUF1	29.9N	081.3W	0742	25.8	27.6				7.3	SW	20.4	11/23	1018.3
SBIO1	41.6N	082.8W	0740	20.3					9.1	SW	29.7	28/22	1017.9
SGNW3	43.8N	087.7W	0742	17.7					10.3	S	24.5	08/02	1018.3
SISW1	48.3N	122.9W	0741	13.7					7.0	SW	23.6	04/06	1018.3
SMKF1	24.6N	081.1W	0738	28.9	29.9				9.7	E	31.7	24/12	1017.3
SPGF1	26.7N	079.0W	0739	28.1	29.8				5.3	SE	37.9	24/05	1018.8
SRST2	29.7N	094.1W	0739	26.4					7.8	S	20.2	24/20	1016.3
STDM4	47.2N	087.2W	0742	14.6					13.5	NW	33.7	30/08	1016.5

NDBC Station Data Summary

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SUPN6	44.5N	075.8W	0608	18.8	19.9				9.3	SW	30.8	29/17	1017.9
TTIW1	48.4N	124.7W	0741	13.5					9.5	S	28.2	10/15	1018.9
VENF1	27.1N	082.5W	0428	26.3	30.4				5.9	E	19.4	09/20	1017.8
WPOW1	47.7N	122.4W	0741	16.4					4.2	NE	15.4	06/18	1017.3
SEPTEMBER 1992													
32302	18.0S	085.1W	0709	17.5	18.4	2.4	4.9	23/17	14.2	SE	23.3	24/04	1017.7
41001	34.9N	073.0W	0716	25.4	26.7	1.5	4.6	24/14	11.7	SE	24.5	24/20	1018.7
41002	32.3N	075.2W	0220	25.9	27.5	2.2	4.1	30/19	14.0	E	30.3	30/18	1014.2
41004	32.5N	079.1W	0716	25.5	27.0	1.1	3.6	30/03	10.8	NE	26.8	30/01	1018.6
41006	29.3N	077.4W	0718	27.5	28.7	1.5	5.2	30/16	10.4	E	28.4	30/08	1016.7
41009	28.5N	080.2W	1417	27.3	27.9	1.0	3.6	30/23	9.5	E	23.9	30/23	1016.3
41010	28.9N	078.5W	1418	27.4	28.7	1.4	4.6	30/23	10.7	E	32.3	29/06	1016.4
41016	24.6N	076.5W	0716	28.0	29.1	0.6	1.3	04/06	11.8	E	32.5	30/01	1015.0
42001	25.9N	089.7W	0717	28.1	29.3	0.8	2.6	15/03	9.0	E	22.0	29/08	1015.6
42002	25.9N	093.6W	0672	28.1	29.2	0.9	4.1	29/13	10.5	E	30.7	29/06	1014.7
42003	25.9N	085.9W	0719	28.0	28.9	0.6	1.8	14/19	10.1	E	22.0	30/22	1015.7
42007	30.1N	088.8W	0716	26.1	27.9				11.4	NE	26.6	26/15	1016.3
42019	27.9N	095.0W	0718	27.8	28.9	1.1	3.9	29/20	11.8	SE	25.5	29/06	1014.8
42020	27.0N	096.5W	0718	27.9	28.7	1.1	3.4	29/22	12.2	SE	24.5	23/03	1014.5
44005	42.6N	068.6W	0685	15.3	15.3	1.1	3.4	30/04	11.5	S	29.0	30/01	1020.8
44007	43.5N	070.1W	0719	14.3	13.6	0.6	2.0	04/05	10.5	S	25.5	23/02	1020.4
44008	40.5N	069.4W	0715	17.6	17.7	1.1	3.5	24/17	12.2	NE	29.1	24/15	1020.9
44009	38.5N	074.7W	0713	21.0	21.8	1.1	4.1	25/20	13.1	NE	35.4	25/20	1020.5
44011	41.1N	066.6W	0700	18.1	19.0	1.4	3.7	24/16	11.6	S	27.8	24/04	1021.6
44012	38.8N	074.6W	0718	20.5	21.4	1.0	4.0	25/23	12.8	S	36.7	25/21	1020.4
44013	42.4N	070.8W	0714	15.9	14.3	0.5	2.0	24/11	11.0	SW	27.4	03/19	1021.1
44014	36.6N	074.8W	0693	22.7		1.4	5.4	25/16	9.7	NE	29.5	24/22	1019.1
44025	40.3N	073.2W	0706	19.7	20.0	1.1	4.0	26/02	11.6	S	28.2	26/03	1021.0
45001	48.1N	087.8W	0716	10.2	8.9	1.0	4.1	28/13	12.7	S	35.8	28/13	1013.5
45002	45.3N	086.4W	0718	14.6	15.5	0.9	2.3	13/20	13.3	S	27.6	28/16	1016.5
45003	45.3N	082.7W	0718	13.1	12.7	0.9	4.7	29/00	12.2	S	35.8	29/00	1017.3
45004	47.5N	086.5W	0715	10.4	9.5	1.0	5.0	28/17	13.2	SE	35.8	28/16	1014.3
45005	41.7N	082.4W	0718	18.3	20.4	0.5	1.5	23/01	11.0	S	26.2	27/12	1019.4
45006	47.3N	089.5W	0716	11.3	9.9	0.8	3.1	28/09	9.3	S	26.4	28/08	1013.9
45007	42.8N	087.1W	0716	16.6	17.6	0.7	2.8	09/21	11.7	S	30.7	09/18	1018.0
45008	44.3N	082.4W	0717	15.2	16.0	0.9	3.3	29/02	10.9	S	27.4	27/13	1018.8
46001	56.3N	148.2W	0713	9.6	11.0	2.3	6.0	29/16	14.6	W	29.1	29/13	1008.5
46002	42.5N	130.3W	0713	17.4	18.2	2.1	5.4	30/21	12.7	N	25.3	15/17	1018.4
46003	51.9N	155.9W	0717	10.5	11.1	2.6	7.0	29/02	16.2	W	32.4	27/12	1012.7
46005	46.1N	131.0W	0712	15.7	16.8	2.2	5.7	24/12	12.4	NW	29.9	14/15	1018.1
46006	40.9N	137.5W	0712	18.6	19.6	2.2	8.0	15/06	11.2	NE	33.6	15/00	1021.7
46011	34.9N	120.9W	0703	15.2	15.8	1.7	3.8	26/03	10.4	NW	25.6	05/00	1013.3
46012	37.4N	122.7W	0708	14.6	15.2	1.6	4.2	26/05	7.9	NW	25.6	25/03	1014.3
46013	38.2N	123.3W	0709	13.5	13.3	1.7	4.0	26/04	10.7	NW	32.1	25/02	1013.4
46014	39.2N	124.0W	0711	13.3	13.4	1.8	4.0	25/16	11.2	NW	29.0	13/04	1014.2
46022	40.8N	124.5W	0719	12.8	12.5	1.9	4.2	13/04	9.3	N	27.8	22/20	1015.8
46023	34.3N	120.7W	0714	15.6	16.2	1.8	3.8	26/06	14.5	NW	24.5	05/04	1012.7
46025	33.8N	119.1W	0717	18.7	20.1	0.9	2.0	04/03	6.1	NW	20.6	04/01	1012.1
46027	41.8N	124.4W	0670	12.1	11.3	1.8	3.7	25/06					1015.5
46028	35.8N	121.9W	0713	15.0		1.8	4.1	26/01	11.6	NW	30.1	25/02	1013.9
46029	46.2N	124.2W	0714	13.6	13.3	1.6	4.4	24/20	8.8	N	25.1	23/18	1017.9
46035	57.0N	177.7W	0719	7.0	8.5	2.3	6.9	25/22	14.5	NE	36.7	30/22	1014.9
46041	47.4N	124.5W	0692	12.2	12.2	1.6	3.6	24/17	7.6	NW	21.2	23/16	1017.1
46042	36.8N	122.4W	0701	14.4		1.6	4.0	25/22	9.0	NW	23.3	13/00	1014.5
46047	32.7N	119.6W	0712	17.5	19.7	1.8	2.9	04/10	13.1	NW	26.2	04/09	1012.6
46048	32.9N	117.9W	0717	19.7	21.2	0.9	1.9	04/08	7.7	NW	19.2	04/04	1011.7
46050	44.6N	124.5W	0705	12.8	12.0	1.7	4.2	25/01	9.2	N	24.7	30/19	1017.8
46051	34.5N	120.7W	0709	15.0	15.3	1.7	3.1	25/00	12.7	NW	21.0	20/05	1013.2
51001	23.4N	162.3W	0720	26.2	27.1	1.9	3.5	12/03	12.0	E	20.4	04/07	1013.9
51002	17.2N	157.8W	0712	27.4	28.0	2.1	6.0	11/07	11.9	E	31.8	11/06	1012.0
51003	19.3N	160.8W	0715	26.8	27.7	1.8	5.5	11/15	11.0	E	37.7	11/15	1011.2
51004	17.4N	152.5W	0716	26.6	27.3	2.0	4.0	10/01	11.9	E	21.5	09/02	1010.8
52009	13.7N	144.7E	0161	27.9	28.1	1.4	2.1	26/01					1008.3
91222	18.1N	145.8E	0641	27.8					8.6	E	33.2	05/08	1005.7
91251	11.4N	162.4E	0701	28.0					9.9	W	25.0	11/22	1008.7
91328	8.6N	149.7E	0294	27.9					5.3	NE	14.0	24/06	1008.3
91343	7.6N	155.2E	0693	28.3					3.4	SW	26.3	24/18	1009.3
91352	6.2N	160.7E	0642	28.2					6.0	SW	28.1	12/00	1009.1
91355	5.4N	163.0E	0705	27.5					7.1	E	25.7	23/02	1008.5
91377	6.1N	172.1E	0710	28.3									1008.6
ABAN6	44.3N	075.9W	0718	15.7	18.8				3.7	S	18.1	10/11	1020.8
ALSN6	40.5N	073.8W	0718	18.8	20.0	0.9	3.2	26/06	14.0	S	40.2	26/02	1021.6
BURL1	28.9N	089.4W	0711	27.0					10.7	E	30.3	16/02	1016.7
BUSL1	27.9N	090.9W	0717		28.3								
CARO3	43.3N	124.4W	0714	12.6					8.3	NE	33.6	30/23	1016.5
CHLV2	36.9N	075.7W	0716	22.1	22.8	1.1	4.5	25/18	13.1	NE	44.3	25/18	1020.6
CLKN7	34.6N	076.5W	0718	24.5					10.4	NE	26.8	24/18	1019.8

NDBC Station Data Summary

MEAN BUOY (C)	MEAN LAT (C)	MEAN SIG LONG (M)	MAX SIG OBS	AIR TP (M)	MAX SIG SEA TP (DA/HR)	SCALAR MEAN WAVE HT (KNOTS)	PREV WAVE HT (DIR)	MAX WAVE HT (KTS)	MAX WIND (DA/HR)	MEAN SPEED (MB)	WIND	WIND	WIND	PRESS
CSBF1	29.7N	085.4W	0710	25.8						5.3	NE	26.6	05/10	1016.4
DBLN6	42.5N	079.4W	0718	17.1						10.0	SE	39.7	27/16	1019.5
DESW1	47.7N	124.5W	0715	11.9						9.5	NW	31.1	23/17	1017.1
DISW3	47.1N	090.7W	0680	12.9						10.8	S	35.8	28/05	1013.9
DPIA1	30.3N	088.1W	0713	25.8	27.8					10.5	NE	25.3	29/06	1017.1
DSLN7	35.2N	075.3W	0718	24.5	26.1	1.4	5.8	25/01		13.2	NE	41.1	25/00	1019.6
FBIS1	32.7N	079.9W	0718	24.7						9.5	NE	27.5	29/19	1018.6
FFIA2	57.3N	133.6W	0717	9.1						11.8	SE	35.4	07/01	1008.7
FPSN7	33.5N	077.6W	0718	25.5	27.5					12.9	NE	36.5	30/05	1018.9
FWYF1	25.6N	080.1W	0344	27.7	28.7									1013.1
GBCL1	27.8N	093.1W	0032	27.9	28.9					13.5	SE	23.6	02/07	1017.5
GDIL1	29.3N	090.0W	0689	26.5	28.5					10.0	NE	30.6	22/19	1015.8
GLLN6	43.9N	076.5W	0716	16.5						13.3	S	32.6	27/20	1019.8
IOSN3	43.0N	070.6W	0716	15.3						12.8	S	29.9	29/23	1020.9
MDRM1	44.0N	068.1W	0719	12.4						12.7	S	31.0	30/00	1020.6
MISM1	43.8N	068.9W	0717	13.0						12.9	S	33.8	30/06	1020.7
MLRF1	25.0N	080.4W	0714	28.0	29.0					9.8	E	22.6	02/22	1014.6
NWPO3	44.6N	124.1W	0708	11.9						7.0	N	22.3	02/20	1017.5
PILM4	48.2N	088.4W	0718	11.2						14.8	S	37.4	28/14	1013.3
PTAC1	39.0N	123.7W	0714	12.9						9.4	N	24.9	25/07	1014.8
PTAT2	27.8N	097.1W	0714	27.4	28.8					13.8	SE	27.6	29/17	1014.4
PTGC1	34.6N	120.7W	0711	14.7						16.2	N	28.4	21/07	1013.1
ROAM4	47.9N	089.3W	0717	11.8	11.0					16.0	S	42.7	28/11	1013.3
SANF1	24.5N	081.9W	0718	27.8	28.9					9.6	E	24.1	13/11	1014.5
SAUF1	29.9N	081.3W	0714	26.2	27.8					10.6	NE	32.3	30/01	1017.0
SBIO1	41.6N	082.8W	0717	18.2						11.2	S	31.7	10/03	1018.9
SGNW3	43.8N	087.7W	0670	14.1	10.0					10.7	S	30.1	09/13	1016.6
SISW1	48.3N	122.9W	0715	12.3						9.4	W	35.5	23/18	1016.7
SMKF1	24.6N	081.1W	0715	28.2	29.2					10.2	E	30.7	04/06	1014.8
SPGF1	26.7N	079.0W	0712	27.6	29.3					6.6	SE	20.5	05/21	1016.3
SRST2	29.7N	094.1W	0712	26.0						10.8	S	21.6	29/18	1015.4
STDM4	47.2N	087.2W	0715	12.3						19.4	S	50.5	28/16	1014.0
SUPN6	44.5N	075.8W	0717	15.8	19.0					9.2	S	32.7	27/20	1019.9
TTIW1	48.4N	124.7W	0713	11.7						11.1	S	42.0	26/13	1017.2
VENF1	27.1N	082.5W	0480	26.1	29.5					6.4	NE	18.6	29/00	1014.8
WPOW1	47.7N	122.4W	0712	13.9						5.6	N	26.3	08/08	1015.9



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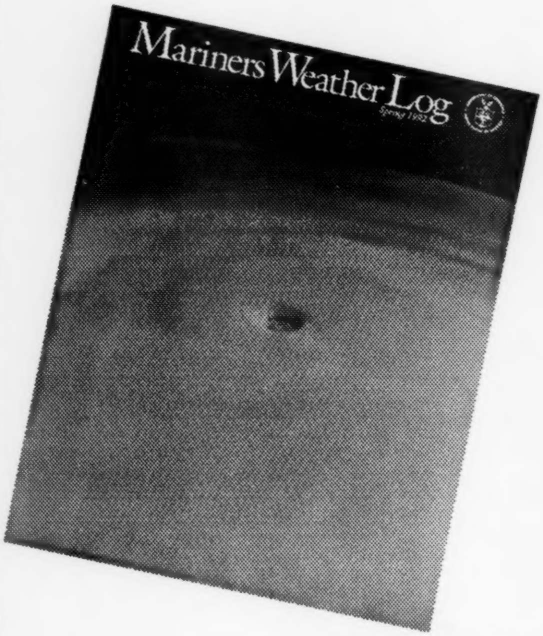

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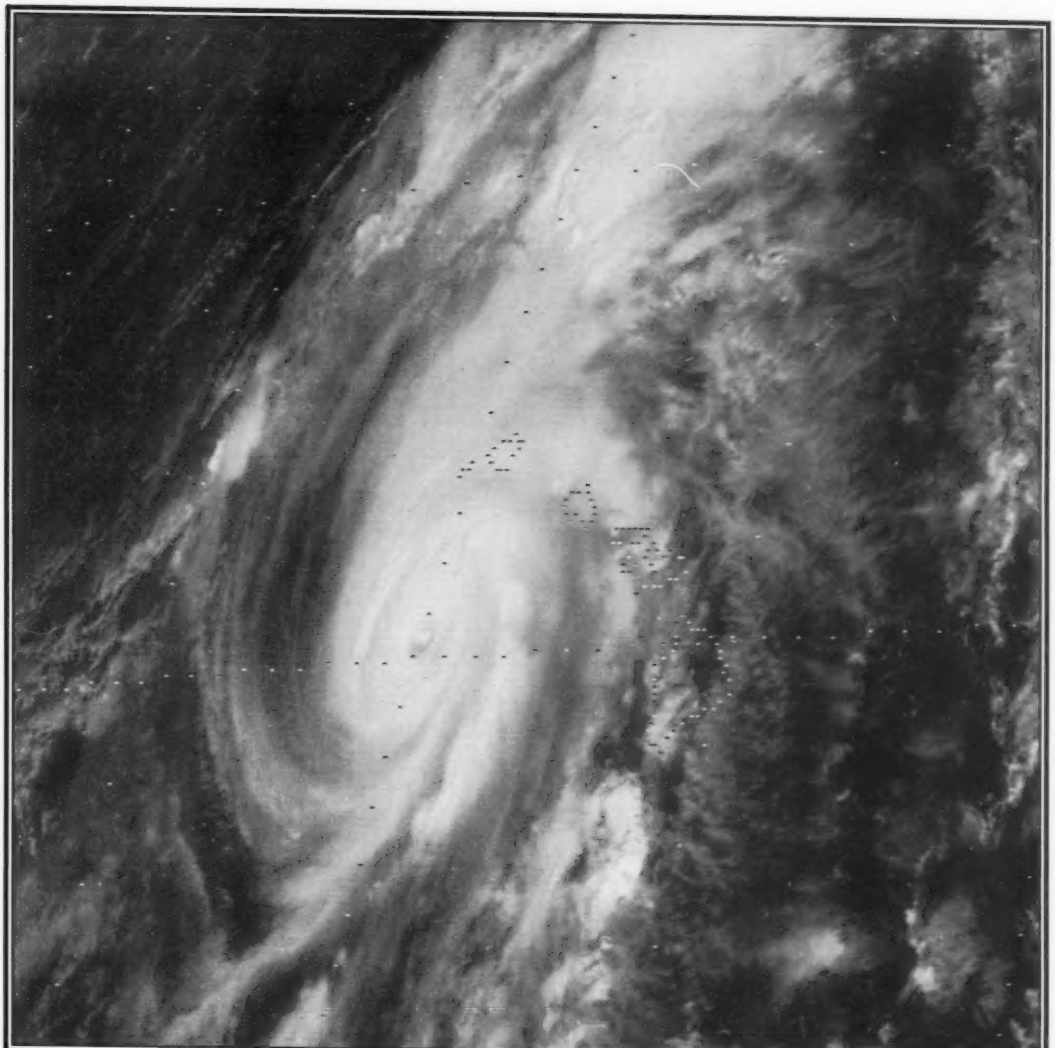

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